VOL. XIV. Nº 9

SEPTEMBER 1929

MECCANO MAGAZINE

6D.

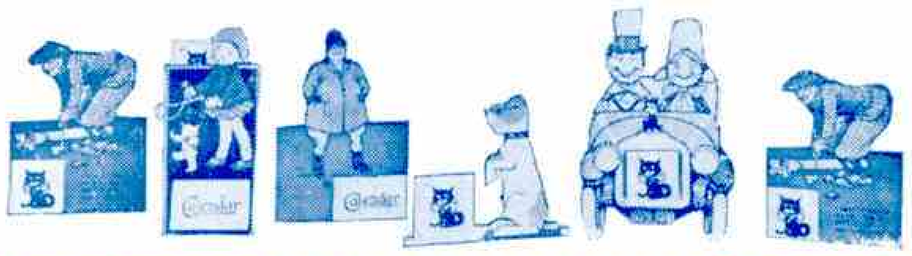
HARNESSING NIAGARA RIVER

(see page 674)

USE YOUR HANDS FOR PROFIT!

Wouldn't your friends like these Calendars?

You know those quaint little calendar pictures you see in stationers' windows at Christmas. Do you know you can cut them out quite cheaply with a fretsaw for your friends or even to sell to the shops? A delightful and simple pastime for anyone with a fretwork outfit—and one providing useful pocket money.

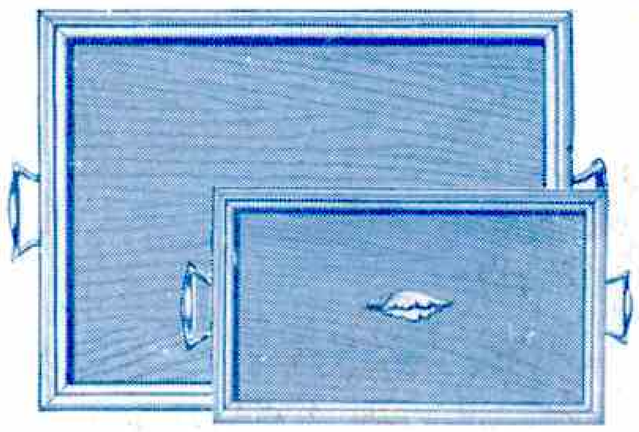


Why spend money on buying presents?

Instead of having to spend your money on presents for people any lad who is handy with tools can make his own. All sorts of fretwork designs are obtainable from Hobbies so you can cut out and make in wood just the things that people want, and you will enjoy the making as much as they will admire your ability. Over 1,000 things to make are shown in Hobbies Catalogue.

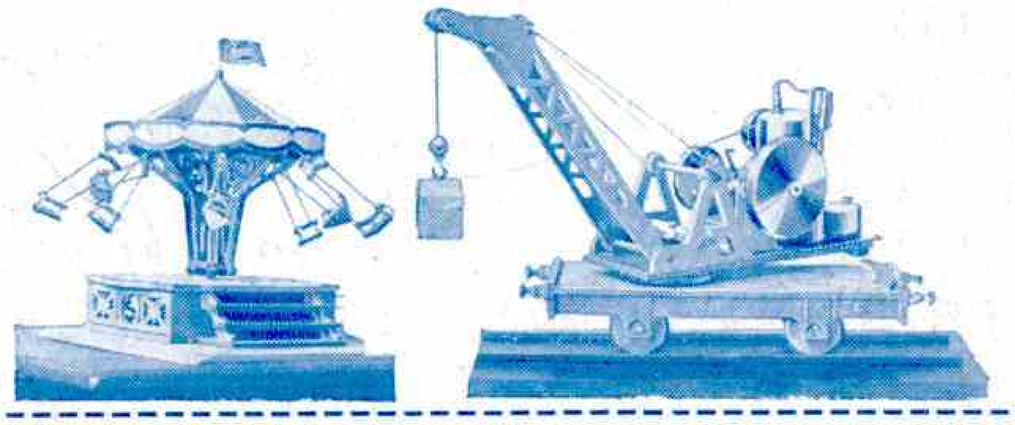
Earn pocket money at tray making!

Do you know that Hobbies supply complete parcels of wood, moulding, and handles for the handyman to make up trays? Quite easy and quite cheap; a source of profit for your spare time. Or there is a handsome colour tray bottom with the picture printed in bright colours upon it. A full range is illustrated in Hobbies Catalogue.



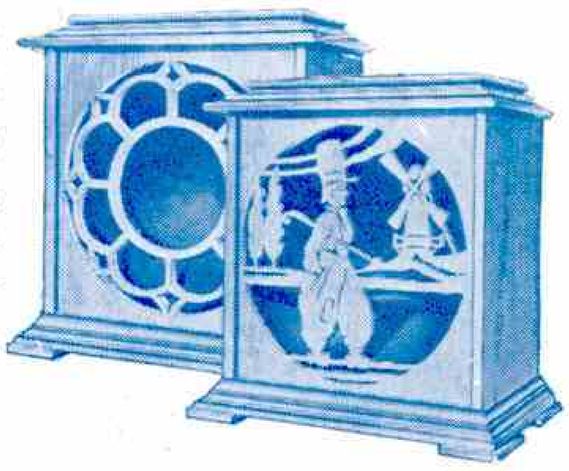
Have you tried to make these models?

The making of real models is a joy known to every Meccano lad. Here are some he can build in wood, after having cut and tested the parts himself. Every piece is the result of his own work—and the models can be driven by a steam engine just like the real thing.



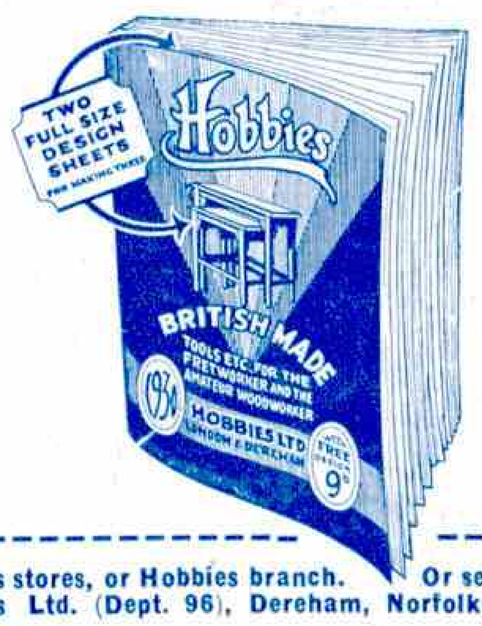
Why not build your own loudspeaker?

It is really quite simple and any lad can do it with the complete patterns and instructions supplied by Hobbies. Either of these handsome cabinets is made in Mahogany for 5/6. Just think of the pocket money you can earn by making them to sell to your friends. The whole thing costs only 22/4—equal in efficiency to any three-guinea model.



Do you want Fretwork designs worth 2/- free?

Of course you do. The new 1930 Hobbies Catalogue has two large designs and pages of complete patterns for making a simple working model, a useful card box and trump indicator, an overmantel and two tables. In addition there is a coloured picture calendar for you to cut out. This book contains details as well as nearly twenty different pastimes. It will keep you interested in all your spare time and will enable you to turn it into profit.



JUST OUT

DETAILS OF ALL THE ABOVE ARE GIVEN IN THE 272 PAGES OF HOBBIES 1930 CATALOGUE. EDITORIAL ARTICLES ON A NUMBER OF NEW SUBJECTS; AND OF INTEREST TO ALL. THE COST IS ONLY 9d. AND THE FREE DESIGNS ALONE ARE WORTH 2/-. GET YOUR COPY NOW.

Ask for one at any newsagent, ironmonger's stores, or Hobbies branch. Or send a Postal Order for 1/- for one to Hobbies Ltd. (Dept. 96), Dereham, Norfolk.

HOBBIES CATALOGUE

MECCANO MAGAZINE

Editorial Office:
Binns Road
Liverpool
England

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September, 1929

With the Editor

"What am I Going To Be"?

"What am I going to be"? is a question that confronts most boys towards the end of their career at school. With many boys, of course, the question does not arise, because it has already been settled. For instance, there is the boy who has a father or near relative in a position to start him off on a definite career with good prospects. In such a case the boy's future is often settled in very early life, and he grows up just taking the whole thing for granted. Then there are boys who become doctors, lawyers, clergymen, etc., for the reason that their fathers are in one or other of these professions.

Although there are large numbers of such boys, they are nevertheless in a small minority, and as their careers are arranged for them automatically they do not require advice. The majority of boys have no such plain and direct pathway in front of them, and the problem of their career is very largely a matter for their own decision.

Probably few decisions are quite so difficult to make, because most boys do not possess ability in any one direction so outstanding as to settle the matter straight away. The average boy has moderate ability in many directions, and he is interested in a great number of widely differing subjects. I have come in contact personally or through correspondence, with many thousands of boys, and I know how difficult it is for them to decide definitely and wisely upon the career for which they are best suited.

Likes and dislikes must be taken into consideration in making the choice, but they must not be allowed to assume too important a place. For instance, a boy may be interested in mechanical matters, may be a good Meccano model-builder, and have a good idea of engines in general; and yet be a hopeless failure in an engineering career. Again, a boy who is interested in outdoor pursuits and is fond of animals might be a complete failure as a farmer. The only way to make a sound choice is to think the thing out carefully from the start.

A friend of mine, who is the headmaster of a very successful boys' school, makes his older pupils put themselves through an examination on definite lines. He hands them a big sheet of paper on which are arranged one below the other the names of a large number of professional and other occupations. Each boy takes his sheet away and sits down quietly by himself to study it and then commence his self-examination.

He begins by crossing out all the occupations that are impossible for him for one reason or another. Some would involve costlier training expenses than his people could afford; others might be too strenuous for him on account of some slight physical weakness; others again would be crossed off for the very sound reason that they would involve a type of work for which he not only has no ability, but which would be extremely distasteful.

Detailed Advice on Careers

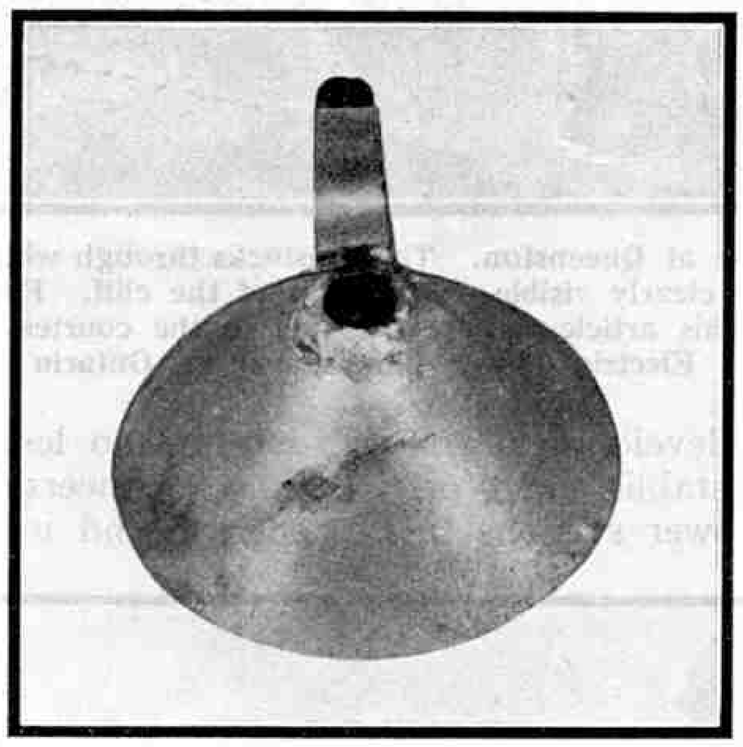
This preliminary weeding out usually thins the list to comparatively small dimensions, and each occupation remaining is given serious consideration from every point of view. Then the occupations are rejected one by one until the choice remains between two or three. These are probably very similar to one another, and at this point a friendly chat with someone who has practical knowledge is sufficient to enable the final decision to be made.

My correspondence has shown me that there are thousands of boys who are not in a position to obtain really practical advice to help them to make their final decision regarding their life work. I therefore decided some time ago that, as Editor of the most popular boys' paper in the world, it was my duty to help my readers in a more systematic manner than had ever been attempted before. With this object I set to work to collect information from all possible sources — manufacturers, merchants, principals of technical colleges, secretaries of institutions, and men who had really "made good" in different spheres of life. All this information has been carefully classified by members of my staff, and I propose month by month to place it at the disposal of my readers.

Each month will appear an article dealing with some individual career, and describing in detail the qualities that it requires, and the best method of entering upon it to ensure success.

As the majority of my readers are mechanically inclined, I intend to deal first with the various branches of engineering—mechanical, electrical, civil, marine, etc.,—and subsequently to pass on to other professions and trades. I should be glad to answer any queries that may arise from these articles, and I hope that readers will not hesitate to write to me regarding any points on which they would like further information.

No. 10. WHAT EVER IS IT?



Here is the tenth little puzzle in the series that is proving so very popular, judging from the number of entries I receive.

Can you identify this mysterious looking object? To the first reader to send an exact answer, or to the reader who gets nearest, I will send an autographed copy of my book "Engineering for Boys."

Solutions should be written on postcards only and addressed "Editorial Competition No. 10, Meccano Magazine, Old Swan, Liverpool." Closing date 30th September.

Mystery Photograph No. 9

If I may judge by the number of readers who decided that it represented a spoon, Mystery Photograph No. 9 was the easiest of the series that has yet appeared. Most of those who did send in wrong solutions named something that resembled a spoon, and the number of entrants who went entirely astray was less than 30.

A few were misled into thinking the object photographed was an ash tray. This was quite a reasonable guess, but I am still trying to see the photograph as it must have appeared to one competitor, who was quite sure that it represented a mandoline!

The first correct solution that came to hand was that of G. C. Richmond, 31, Percy Road, Chester, and to him an autographed copy of my book *"Engineering for Boys"* has been sent.

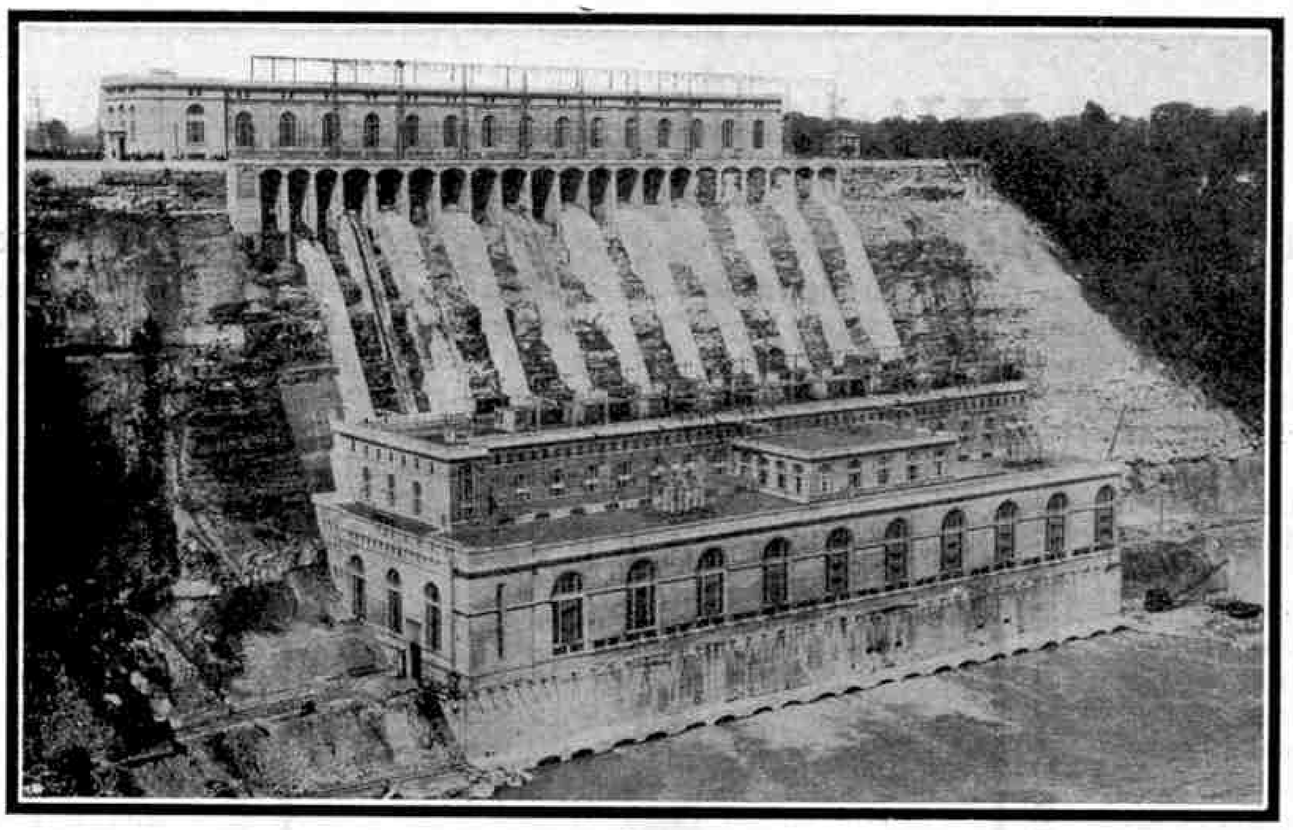
Harnessing Niagara River

Hydro-electric Power Station with Capacity of 550,000 h.p.

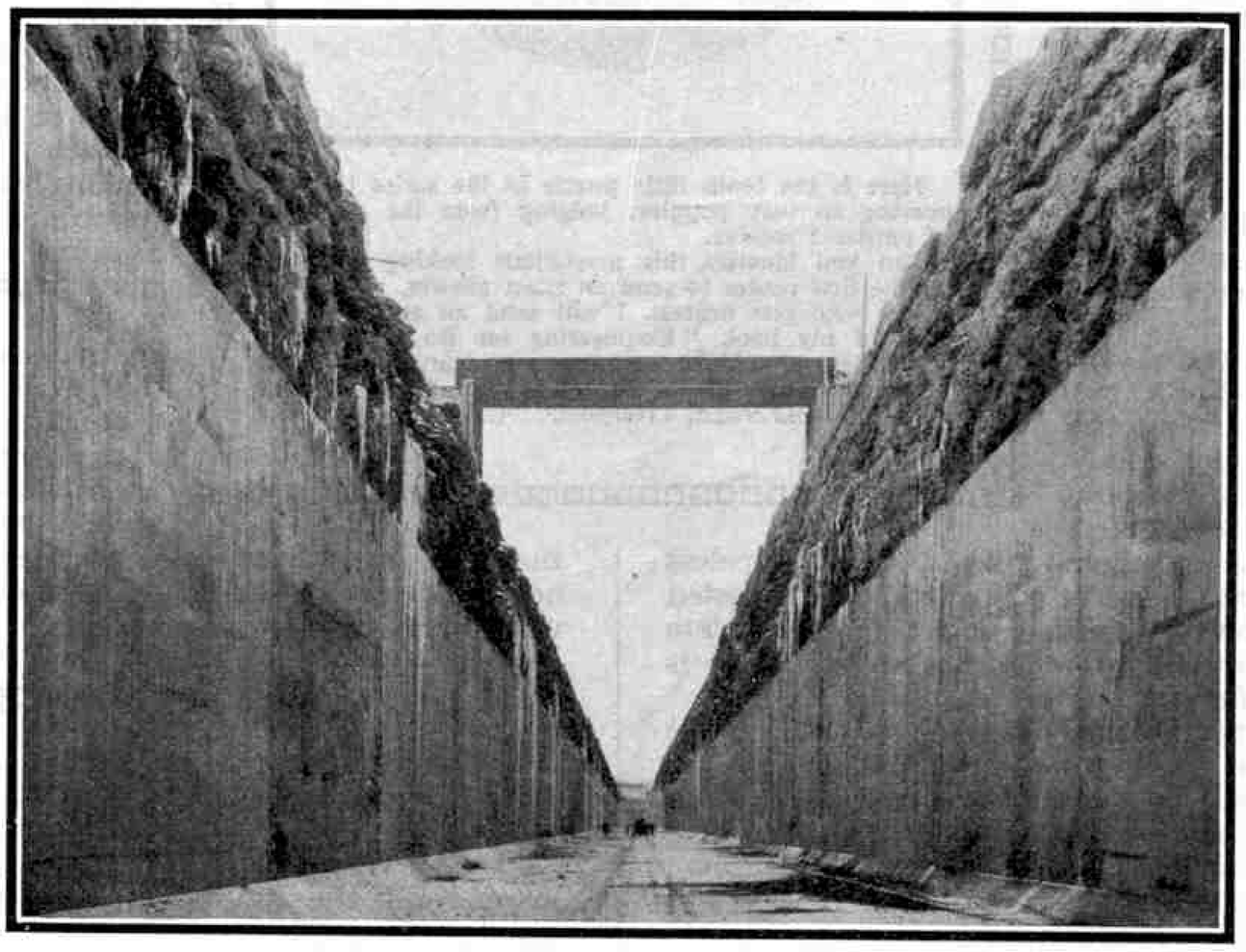
OUR cover this month shows the interior of the generating station at Queenston, Ontario. This is the largest and finest hydro-electric power station in the world, and is the final instalment of a gigantic scheme to harness Niagara River. It was completed to its full capacity of 442,000 k.v.a. in December 1925, and since that time it has supplied current for lighting and power purposes over a very large area of the province of Ontario.

For more than 100 years after their discovery Niagara Falls were regarded as nothing more than a wonderful spectacle. During last century it was seen that they also were a source of enormous power, and the invention of the dynamo and the development of electrical machinery then led to the establishment on both sides of the Niagara River of power stations in which the generators were operated by means of water-driven turbines. These stations may be regarded as gigantic mills in which the waterwheels turn generators instead of of corn-grinding machinery.

It is scarcely surprising that engineers should turn their attention to Niagara Falls when looking for a natural source of power. The two chief needs of a hydro-electric power station are a good head of water and a constant flow. Both requirements may be obtained without any difficulty at Niagara, for the two sections of the Falls are 162 ft. and 167 ft. in height respectively, and in every second no less than 210,000 cu. ft. of water flows over their limestone brinks!



The power house at Queenston. The penstocks through which water reaches the turbines are clearly visible on the face of the cliff. For this and other illustrations to this article we are indebted to the courtesy of The Hydro-Electric Power Commission of Ontario



View of the Chippawa-Queenston canal in the rock section. In places the bed of the canal is 143 ft. below the surface of the ground

There is little need to fear any great diminution of this ample supply of water, for behind the Falls are four of the largest fresh water lakes in the world. Lakes Superior, Michigan, Huron and Erie collect the water from a catchment area of 260,000 square miles and thus act as vast reservoirs in which is stored the water that maintains the flow at Niagara.

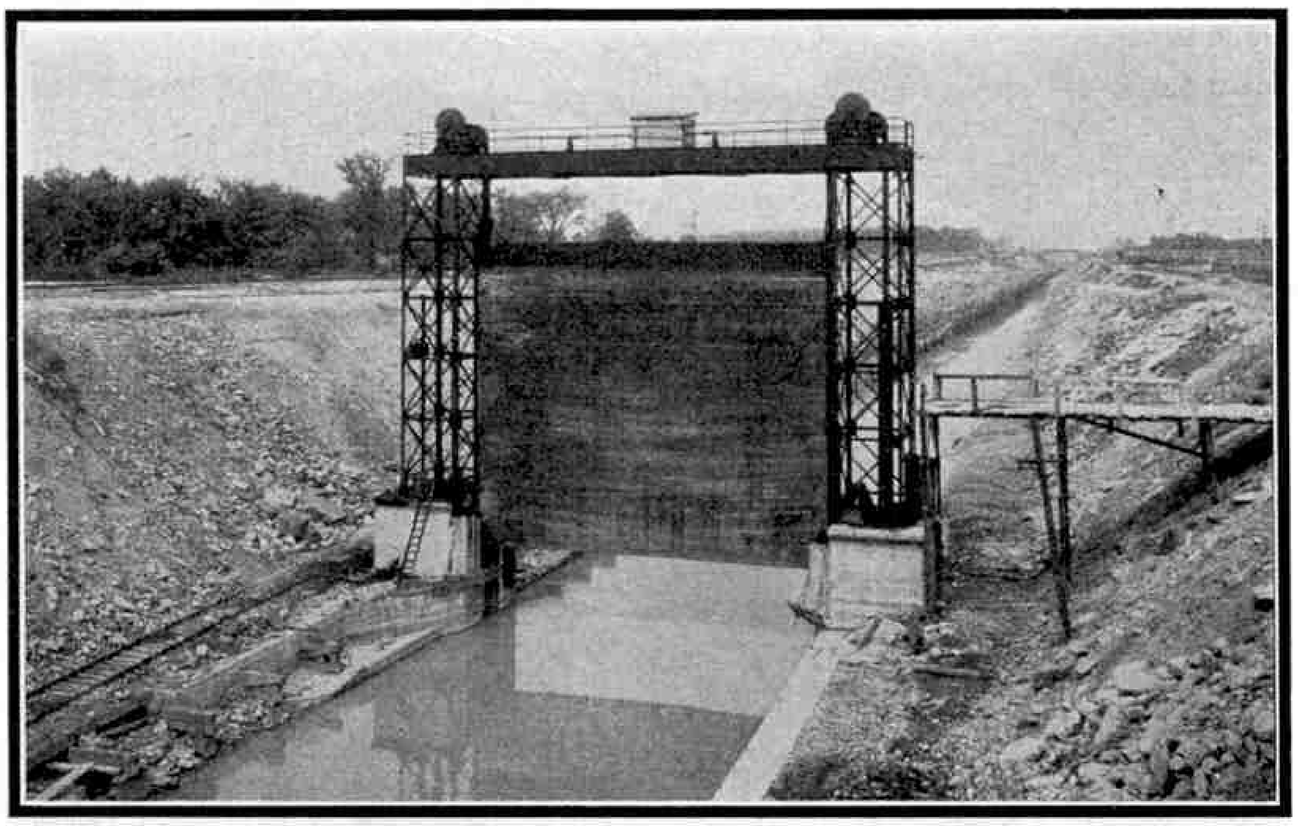
The height of the world-famed Falls is very little more than half of the total head of water available, however, for in its short course of 35 miles from Lake Erie to Lake Ontario, the fall in level of the Niagara River is 326 ft. Such an enormous quantity of water falling through this height could develop no less than 8,000,000 h.p. From time to time engineers have cast longing eyes on this waste energy, and in order to extract some of it for useful purposes have established power stations along the banks of the river near the Falls.

Unfortunately their schemes robbed the Falls of some of their impressiveness, for clearly the diversion of water through the turbines of power stations lessens the quantity that pours over their limestone edges. How the Falls have been affected by the schemes in operation was explained on page 904 of the "*M.M.*" for November, 1928. So serious did the trouble threaten to become that there seemed to be a danger that the Falls would eventually dry up altogether! At this stage the Governments of Canada and the United States stepped in and, by a Treaty signed in 1909-1910, the amount of water that could be diverted for power

purposes was restricted to 56,000 cubic ft. per second, a quantity little more than one-quarter of the average supply that flows down the Niagara River.

Of the water that may be taken from the river 36,000 cu. ft. may be diverted on the Canadian side and 20,000 cu. ft. on the other side of the river. For engineering reasons it is preferable to take the larger quantity from the Canadian side, but the power derived from the river is shared equally between the two countries.

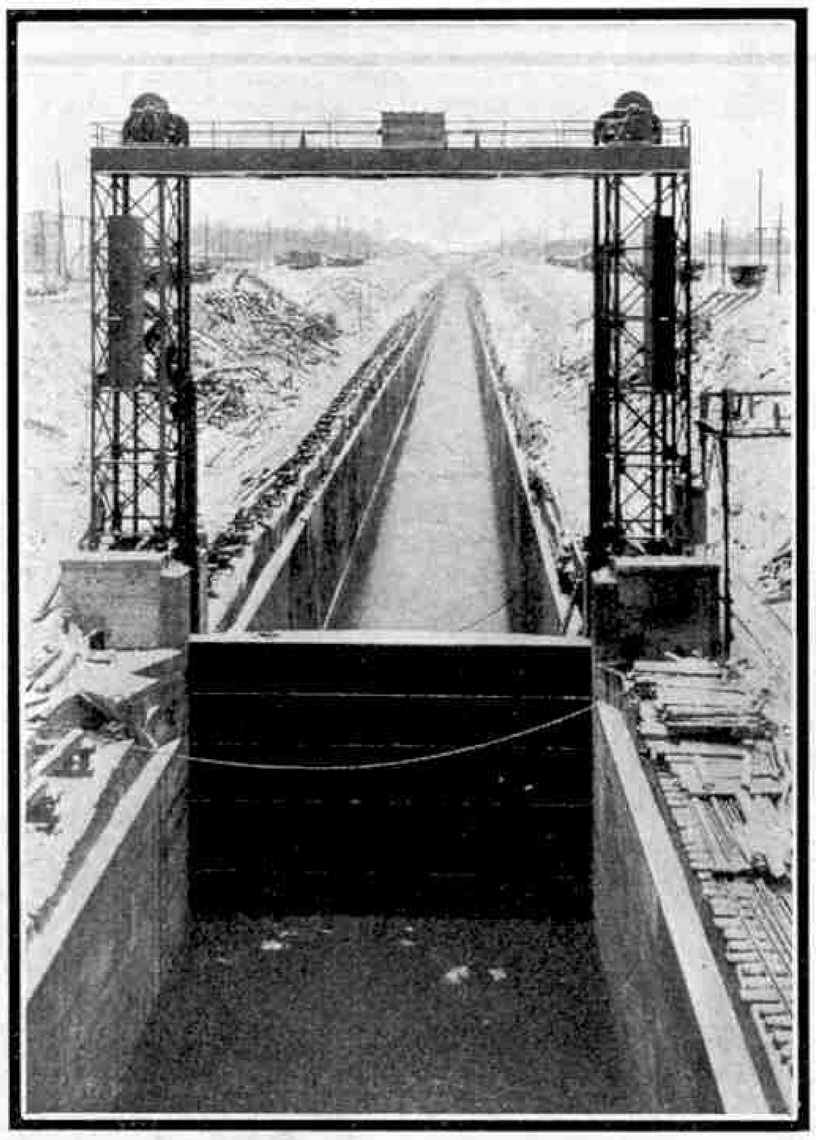
Apart from that produced in two comparatively small stations, all the hydro-electric power generated on the Canadian side of the river is under public ownership and control. The Hydro-Electric Power Commission of Ontario has been formed in order to make the best possible use of the Falls, and for this purpose has erected three large power stations.



Control gate on the canal. It weighs about 100 tons, has a span of 48 ft., and when raised leaves sufficient height for tugs to pass through

The most recent of the three stations is the Queenston-Chippawa plant, which was completed in 1925 and is the largest and most efficient single hydro-electric power plant in the world. By taking in water from a point well above the Falls, and conducting it by means of a canal to a point near Queenston, 12 miles downstream, the station makes use of a fall of 294 ft., this being nearly twice as great as that of the Falls themselves. The water is diverted from the river at Chippawa, and a deep canal, $12\frac{3}{4}$ miles in length, carries it to the power station built on the Canadian side of the river.

In order to realise the magnitude of this magnificent hydro-electric power scheme, the best plan is to follow the course of the water from Chippawa to the power station. At the entrance the water enters the canal through 15 enormous openings in a great concrete barrier, the greater portion of which is submerged. Each of these openings is 18 ft. in width, and they have been specially designed to prevent damage by the floating ice with which the river is heavily charged in winter.



The control gate lowered to cut off the supply of water to the power house

When the water has passed through the openings in the concrete barrier, it enters upon a section of the canal that was constructed by deepening and strengthening the channel of the Welland River. This section is 4 miles in length, and after traversing it, the water turns sharply to the right to follow a second portion excavated in earth. This is a channel with sloping sides, its width at the top being 307 ft. and at the bottom 185 ft. Finally it enters upon a section, $7\frac{1}{4}$ miles in length, the greater part of which has been dug out of solid rock.

The rock cutting is rectangular in section and is 48 ft. in width. In places the depth of rock that had to be removed in order to give a level bed for the canal was no less than 85 ft. The covering of earth above it ranges up to 70 ft. in depth, and in the deepest sections the bed of the canal is 143 ft. below the surface of the ground.

Near the entrance to the rock cut is a gigantic electrically-operated sluice gate that weighs about 100 tons. When raised to its full height a tug is able to pass beneath it, and it can be lowered in order to cut off the flow of water to the power station when this becomes necessary.

After traversing the length of the canal the water pours into a large triangular basin called a forebay, across the base of which is built the screen house. This stands on the top of the cliff, which here is about 320 ft. in height. It contains the entrance to the penstocks, or pipes through which the water leaves the canal in order to pass into the power house itself.

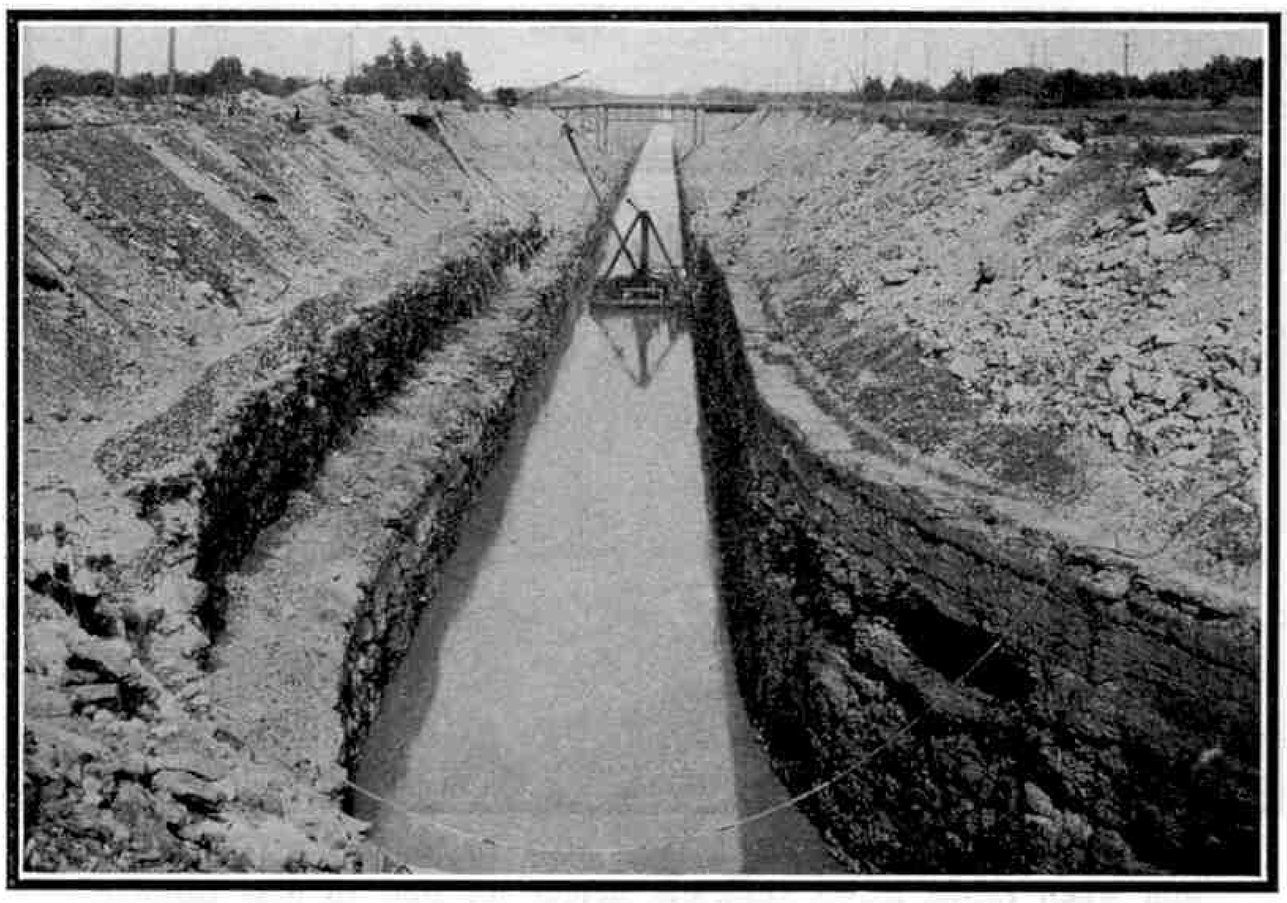
As an engineering feat the construction of the Chippawa-Queenston canal ranks as a work of the first magnitude. In making the cut more than 29,000,000 cu. yds of earth and nearly 4,500,000 cu. yds. of rock were excavated. The section cut through the rock is lined throughout with concrete in order to lessen friction between the water and the walls, a task that involved the use of 450,000 cu. yds of concrete.

Bridges had to be built to accommodate a number of important railway lines and roads intersected by the canal, and at one place it was necessary to carry the canal across an elevation by filling in with excavated material. No less than 82 miles of standard gauge railway track were laid in order to carry away this vast quantity of debris, which was dug out by electrically-operated shovels. At the time when the work was carried out these were the largest in the world. Each was capable of loading a car of 20 cu. yds. capacity, standing 60 ft. above the level, in one and a half minutes.

From the forebay of the canal the water passes through nine sets of triple openings, each of which is provided with a rack or screen in order to prevent debris from

flowing into the power house. These are the openings that lead to the penstocks, the great steel pipes encased in concrete down which the water falls to the hydraulic turbines. They are from 14 to 16 ft. in diameter, and are 383 ft. in length. Water ceaselessly flowing down them acquires an impetus that turns the turbines in the power house of which use is made to rotate the enormous generators.

The penstocks descend the face of the cliff, but a visitor to the screen house who wishes to reach the power house descends by means of an electric elevator into the depths of the rock forming the sides of the gorge of the Niagara River. Arriving at the bottom of the shaft, he emerges from the lift cage into a tunnel that leads directly into the power house itself. This is a mammoth steel and concrete building with nine floors. It rises more than 180 ft. above the rock foundation on which it is built, and yet is only a little more than half the height of the cliff that is behind it. It appears to be dwarfed by the rock face, but it is 560 ft. in length, and if it were placed in front of the American Fall, the latter would be almost hidden from sight in spite of its imposing height and width!



Chippawa-Queenston power canal during construction

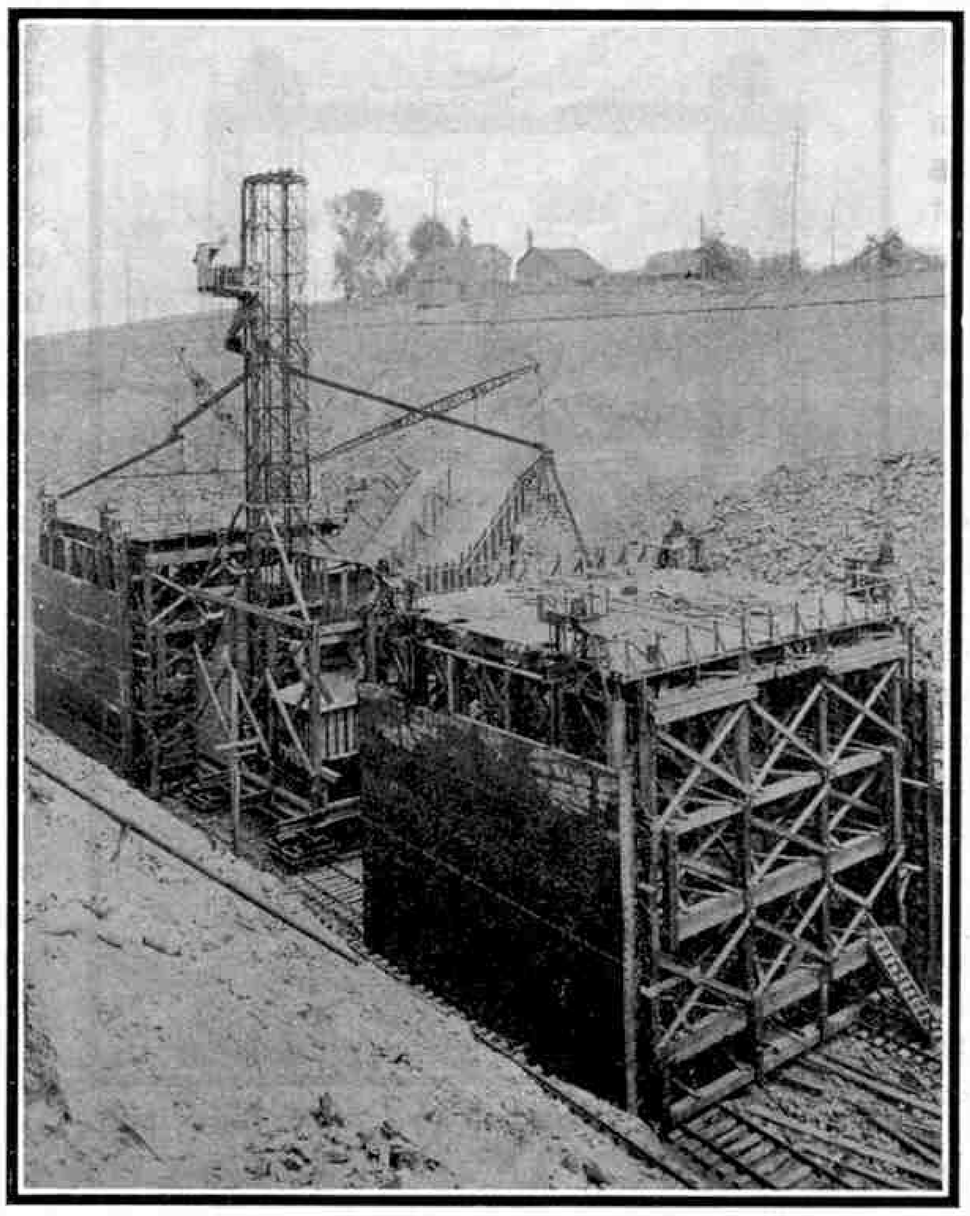
The turbines into which the penstocks discharge the water from the canal are on the lowest floor. Large plunger valves are installed at the lower end of each of the nine penstocks in order to control the flow of water. These may be closed automatically if any emergency arises, and portable headgates may be placed in position at the top of each penstock when it is desired to remove the water from it.

From the valves the water pours out into the river through the turbines of the power units. Of these there are eleven. Nine of them supply mains current for public consumption. The remaining two—which may be seen in the foreground of our cover—are service units, the turbines of which derive their power from the flow of water down a smaller additional penstock on the left of those that operate the main units.

Each main unit consists of a turbine, generator and exciter. The turbines are technically described as of the vertical, single-runner type. At maximum load they operate under a head of water of about 294 ft. and at a speed of 187½ revolutions per minute. Their capacities vary from 55,000 to 63,000 h.p., the total capacity being 550,000 h.p.

The huge generators are directly over the turbines, and are enclosed in separate concrete compartments below the main floor. Their rotating parts are directly coupled to the turbine shafts. Above the main floor are visible only the upper bearing brackets, the main thrust bearings and the exciters. The thrust bearings —which are self-oiling—support the entire weight of the rotating parts of turbine, generator and exciter, a total of 340 tons per unit. The weight of a complete main unit is 1,044 tons and the weight on the floor is over 10,000 tons.

On one side of each main unit, stands the governor, which is driven by a belt from the turbine shaft. Its function is to maintain constant speed on the main units by altering the openings of the gates which admit water to the runner of the turbine.



Concrete lining mixer plant and moulds used during the construction of the canal

Three-phase alternating current is generated at 12,000 volts and at a frequency of 25 cycles per second. The current from each generator passes through its own switches and transformers. The oil switches are placed at strategic points in each circuit so that in case of trouble they automatically open and thus localize the disturbance and maintain power supply in the mains to the greatest possible extent.

The transformers are used to "step-up" the voltage from 12,000 volts to 110,000 volts for transmission, and there are three to each main unit. The maximum capacity of each is 18,330 k.v.a., and some idea of their magnitude may be derived from the fact that the weight of a single transformer is 100 tons. The aluminium conductors carrying current at this voltage pass out through specially designed structures on the roof of the station, up the cliff to steel towers erected upon the edge of the escarpment, and thence to the transmission lines radiating throughout southern Ontario. Some of the power is sent as far west as Windsor and Sarnia, about 250 miles away. A large proportion circles the end of lake Ontario and reaches Toronto, while a portion crosses the Niagara river at 60,000 volts, and is distributed in the State of New York.

Power developments on such a large scale as that at Queenston are subject to a variety of troubles, among which lightning, wind and sleet play a prominent part. Lightning severely tests the insulating materials of transmission lines and sometimes, in spite of all precautions to by-pass it, enters the generating stations. No harm results unless the insulation fails, but if it fails within the station the damage resulting may be serious and far-reaching. Lightning storms are the cause of more trouble than any other single factor, and perhaps wind with sleet is a close second, for it strains the transmission lines and brings them down. During violent winter storms it often is necessary for linesmen to work under the most trying conditions for long hours without rest, stopping only for necessary food, in order to prevent interruption to service.

A service enemy almost equally dreaded is ice, which occurs in the water supply to the turbines in various forms such as hard blocks, anchor ice and slush. The anchor ice frequently carries with it rocks of considerable size. Every year the ice is fought with all available means, such expedients as mechanical drags, large forces of men with various implements, and the explosive power of dynamite being employed.

In the power houses themselves the operators must constantly be on guard against mechanical and electrical troubles. In many cases they have only a few seconds to recognize trouble, to decide upon the preventive measures, and to make the only move which may save thousands of pounds and safeguard the service. Only by eternal vigilance can excellence in service be maintained and breakdowns prevented.

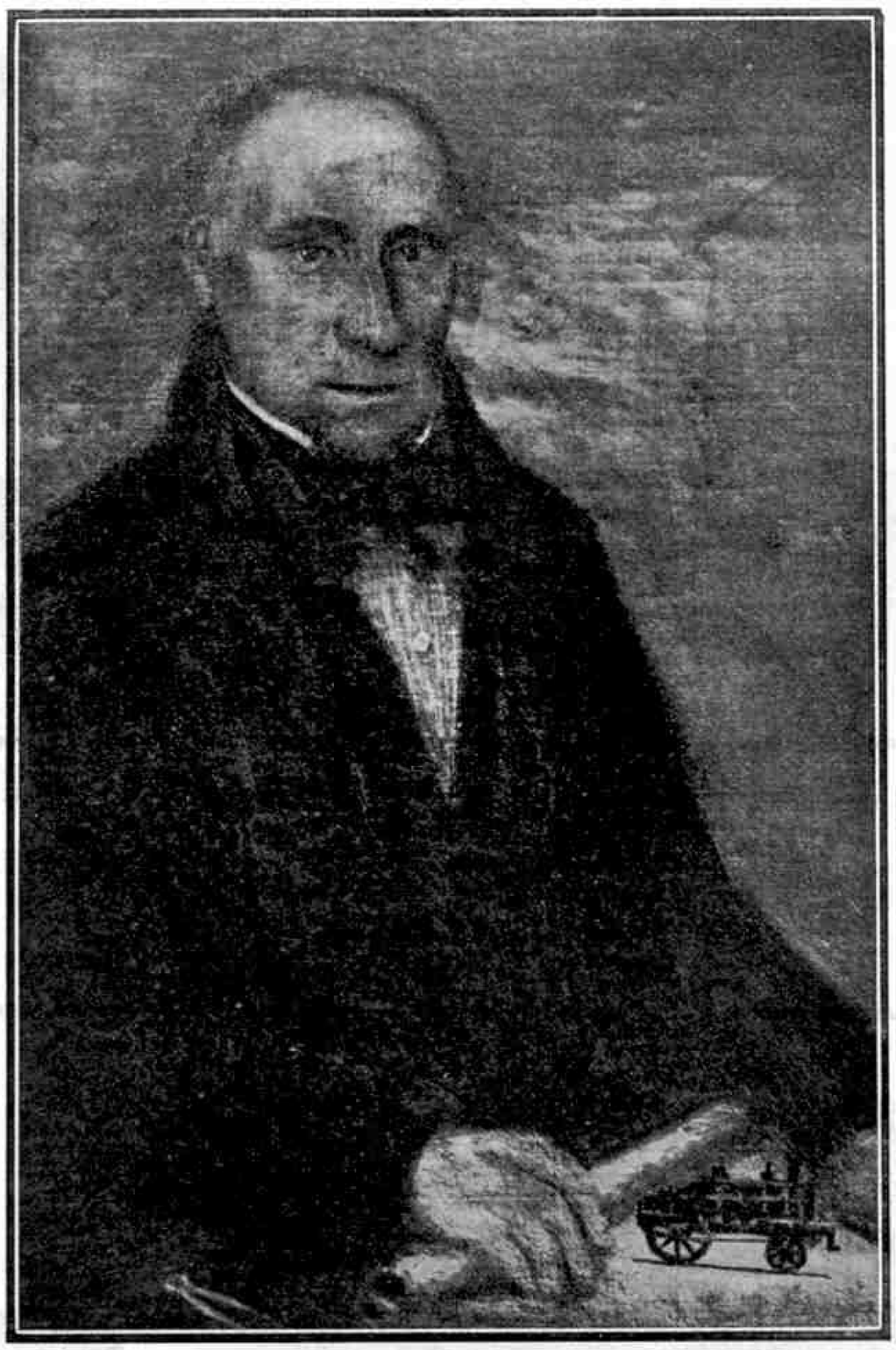
It is difficult to give a satisfactory idea of the enormous power concentrated within the four walls of this greatest hydro-electric power station. So vast is the scale on which it works that its nine units are capable of supplying the

(*Continued on page 696*)

Can Any Reader Identify This?

Portrait of an Unknown Railway Pioneer

WE are all familiar with portraits of George Stephenson and his son Robert, and to a less extent with portraits of Matthew Murray, William Hedley, Timothy Hackworth and a few others among the railway pioneers. Many of the men who helped to bring the railway into being are practically unknown to us, however—their names survive, but that is all. From time to time an old portrait turns up that is obviously of some railway veteran of the past, but to the identity of whom there appears to be no clue. A typical example of such a portrait is reproduced on this page by courtesy of the "*Edgar Allen News.*"



This portrait was sent to Mr. Fred Bland, Director of the Tramway Department, Edgar Allen & Co. Ltd., with a request for the identification of the original if possible. The sitter's railway connection is clearly shown by the half-open scroll on which appears a locomotive. At first sight the task seemed hopeless, but Mr. Bland left no stone unturned. The face was photographed and copies were sent to the National Portrait Gallery and the South Kensington Museum, but the authorities there could not identify the portrait from any others in their possession. An enlarged photograph of the engine was then sent to Mr. J. H. G. Warren, the well-known authority on early locomotives, and he was able to throw some light upon it. He was of opinion that the engine was one built by Messrs. Galloway and Bowman in 1832, and this opinion was confirmed by Galloways Ltd., of Manchester, who stated that the engine corresponded with an original drawing in their possession.

The painting has been described as portraying "a real forceful North Countryman with bold but stern features, keen but kindly eyes and well-formed expressive mouth—a man such as you might expect to have moved mountains to achieve his purpose." Obviously also he was very proud of his locomotive, otherwise he would not have desired it to be included with his portrait. It is thought that the sitter is either Mr. Galloway, Mr. Bowman, or Mr. Glasgow, who were partners in the firm. Even this is not certain, and if any reader can supply information that would help to solve the mystery we should be extremely glad to receive it.

The locomotive itself is interesting inasmuch as it was the first ever built in Manchester. A description by Mr. C. F. Dendy Marshall, M.I.Loco.E., appeared in the "*Engineer*" of July, 1924. He mentions that a good deal of criticism was levelled against the directors of the Liverpool and Manchester Railway. It was said that all their engines were both designed and built by Stephenson, and that even those few constructed by other firms were from Stephenson drawings, and therefore no other locomotive builders had a chance of getting their engines accepted.

Galloway's engine, which was named originally "*Manchester,*" was a complete departure from the Stephenson "*Planet*" type that the company had adopted as a standard. It was of unique design, having the smoke-box in the middle and vertical cylinders in front. It is said that it used to lift itself off the rails! Later on the locomotive was reconstructed and renamed the "*Caledonian.*" The cylinders were then placed centrally with the smoke-box and chimney in the normal position.

Mr. Warren, in his "*A Century of Locomotive Building,*" quotes a minute recorded at a meeting of the directors of the Liverpool and Manchester Railway, from which we learn that the Board "had a decided objection to upright cylinders as injurious to the road as well as causing an objectionable motion to the engine." The discussion had arisen in connection with an engine named "*Experiment,*" constructed by Sharp, Roberts & Co., about the same time as the "*Caledonian.*" Mr. Warren says further that "the '*Caledonian*' and the '*Experiment*' appear to have been the last serious attempts to reintroduce a vertical arrangement of cylinder on the Liverpool and Manchester Railway; both engines were failures."

In the "*Experiment*" the valve of the right-hand cylinder was operated by a short vertical arm on the radius rod of the left-hand cylinder, and similarly the valve of the left-hand cylinder was operated from the right-hand cylinder. This was the first locomotive to have valves operated in this manner.

FAMOUS TRAINS: XXXII.

The "*Kent Coast Express*"

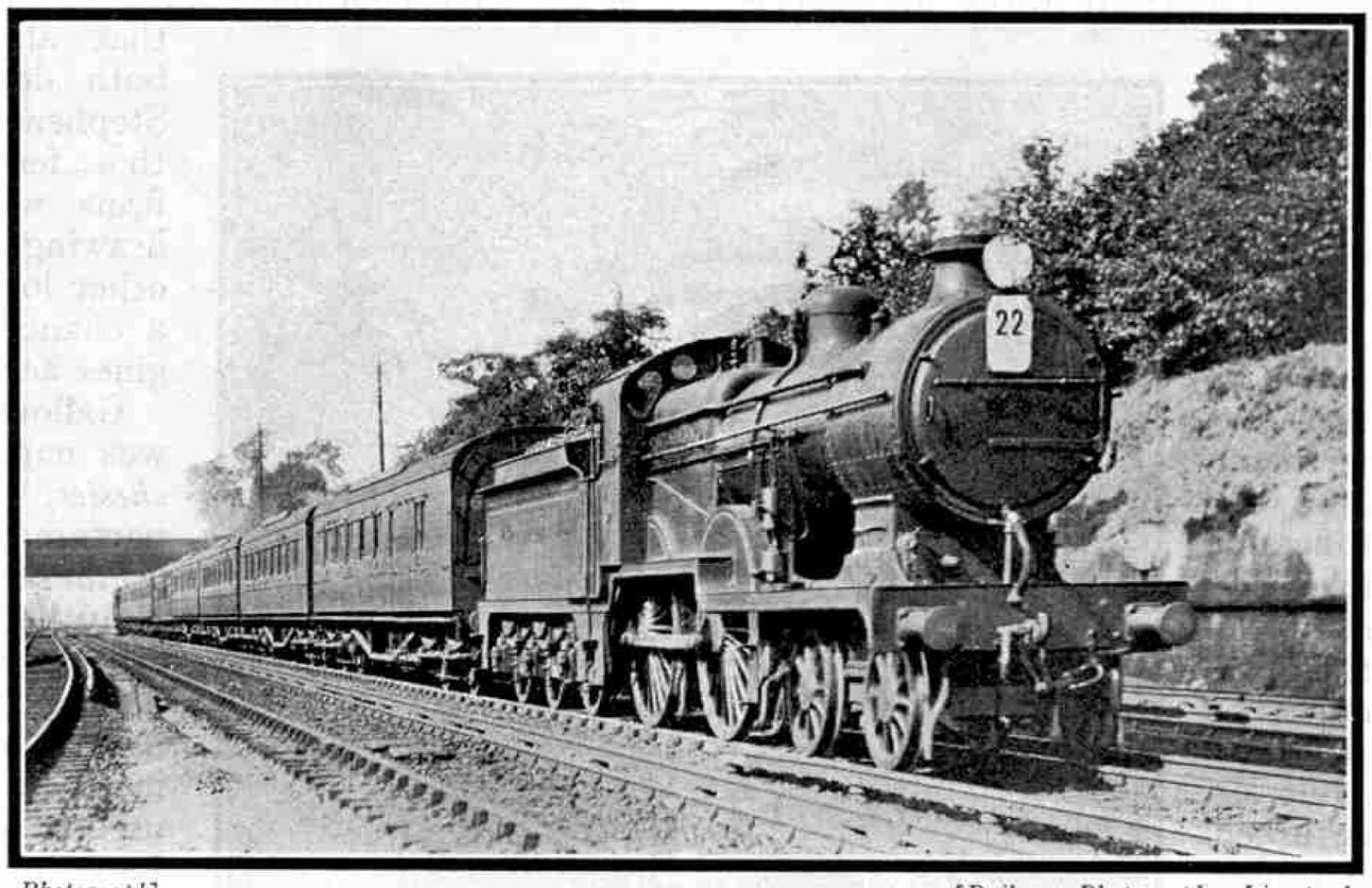
Southern Railway

By Cecil J. Allen, M.Inst.T., etc.

LAST month we travelled from Victoria Station, London, to Newhaven by the Southern Railway Company's "*Newhaven Boat Express*," and this month we are to investigate another of this company's London-to-the-Coast services. Victoria is again our starting point, and we shall find our train at the platform against the wall dividing one half of the station from the other. The train was for many years known as the "*Granville Express*." This was a relic of London, Chatham and Dover days, when special services were instituted in connection with certain hotels on the Kent Coast; but of recent years the title has fallen into disuse.

The name "*Kent Coast Express*" is applied to a good many trains. On a summer Saturday, indeed, such trains follow one another at roughly 10-minute intervals the whole livelong day, together making up a long-distance service that is probably without parallel in Great Britain or in any other country. But the particular train that I have in mind, and the best of the day with one exception, is the express due to leave Victoria at 3.15 p.m. This is booked to run the 74 miles to Margate without a stop in 97 minutes. The only faster service—except on summer Sundays, when the "*Thanet Pullman Limited*" is booked to do the journey to Margate in 90 minutes—is by the "*City Express*" leaving Cannon Street at 5.6 p.m., but the four minutes' less time taken in the latter case is more than counterbalanced by 2½ miles' shorter distance and, in the early stages, an easier road.

We find a corridor train at our disposal. It has in the centre the ubiquitous first-class Pullman car, vestibuled to the coaches on either side, so that everyone who desires it may be served with tea or refreshments *en route*. There are two "composites"; a third and a third brake behind the Pullman; and two composites and a third-class brake, with probably an additional third at this time of the year, in front, making a total of eight or nine coaches. This adds up to a "tare" of between 260 and 300 tons, and a full weight, with passengers and luggage, of between 275 and 320 tons. It may not seem an enormous figure as compared with what is hauled, say, by a "Lord Nelson" on one of the Dover Continental trains, but it is a very heavy load in proportion to the type of engine employed. For it has been necessary, up till now, to restrict the working over the Kent Coast route to 4–4–0 engines, owing to the weakness of certain bridges; and, what is more, to engines whose total weight does not exceed about 50 tons, without their tenders.



Photograph [*Railway Photographs, Liverpool*

The "*Kent Coast Express*" passing Bickley, hauled by a 4–4–0 "L" class locomotive, No. 487

The locomotives generally used on this section are therefore the "rebuilt" 4–4–0 engines of the "D. 1" and "E. 1" classes. It was by a very skilful feat of design that Mr. Maunsell, hampered by the severe weight restrictions of this route, superheated and thoroughly modernised the Wainwright 4–4–0 locomotives, and at the same time materially increased their tractive power, with practically no addition to engine weight. It is sometimes difficult at first to distinguish engines of this type from the more recent "L. 1" class 4–4–0's used on the Folkestone and Dover services. The latter, which are considerably more powerful locomotives, have chimneys of bigger diameter, cabs with side-windows, and a more "thick-set" appearance altogether. In view of the extraordinary difficulty of the gradients, our driver will have his work cut out to keep time, unless we have a clear road and a reasonably fine day.

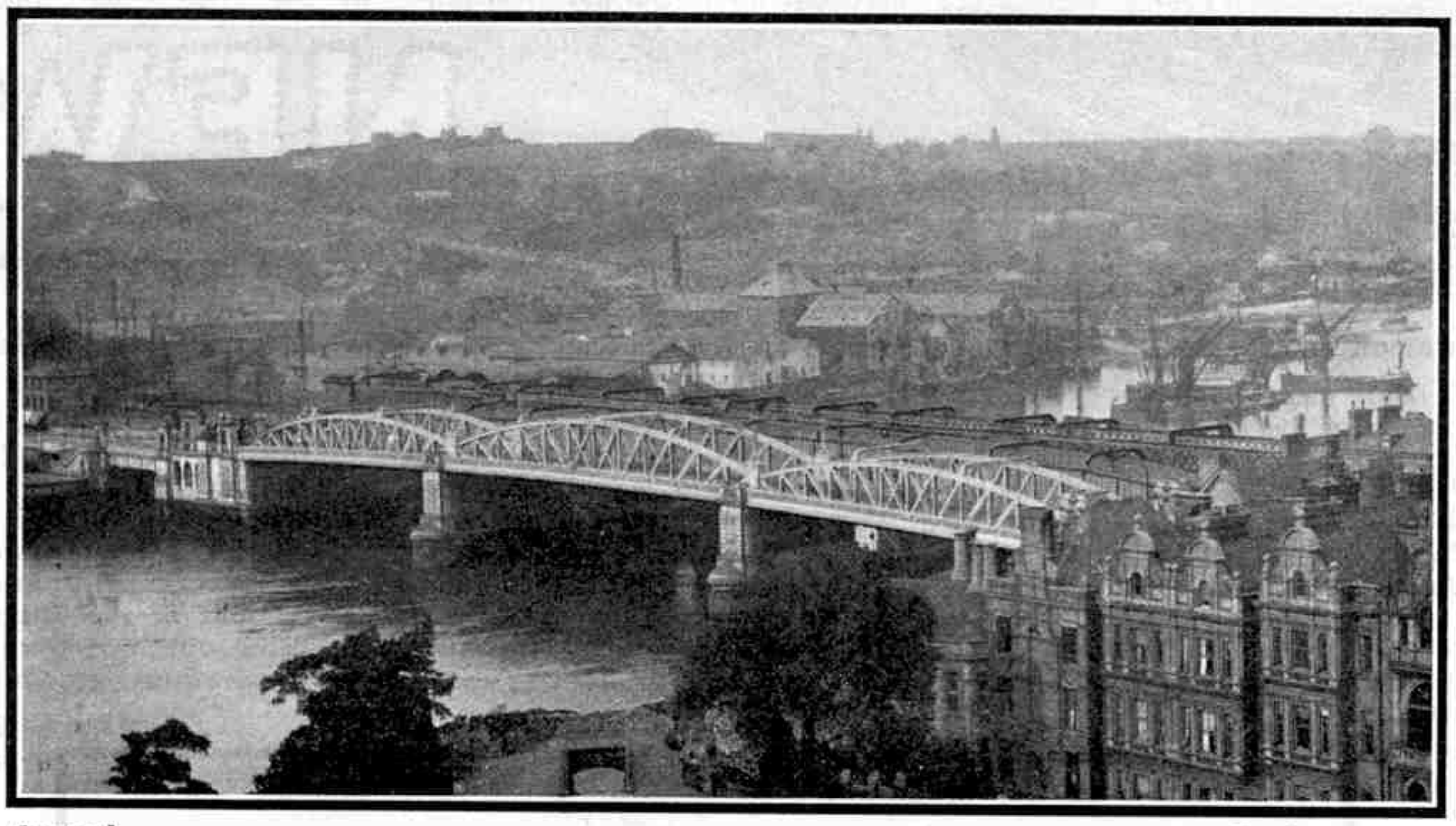
Courtesy [*Southern Railway*

The entrance to Victoria Station, the "gateway to the Kent Coast." Part of the space in front is an omnibus station

Getting away punctually at 3.15 p.m., we have, as was the case last month, to mount the steep incline to Grosvenor Road Bridge, but this time with a 0–6–0 or 0–4–4 tank engine usefully assisting us in rear. Coming out of the other side of Victoria is the 3.15 p.m. Eastbourne express, very probably hauled by a 2–6–0 locomotive. This is yet another Southern wheel arrangement for express passenger trains, and one capable of remarkable speed, too, as I proved on this very Eastbourne train a few days before writing the present article; we kept up a sustained 73 miles an hour past Haywards Heath. With equal loads, however, and our two engines to his one, we shall probably overhaul the Eastbourne people before we have cleared the Thames. Immediately

afterward we take divergent tracks and see each other no more.

There are some sharp undulations through Brixton to Herne Hill which, since the rearrangement of its layout, we may now pass at 40 miles an hour. This is fortunate, as now we have to begin the stiff climb at 1 in 95 to Sydenham Hill, up which we shall drop to 30 miles an hour or so. We see the towers of the Crystal Palace, but under the ridge that carries that structure we are to tunnel. As we enter the mile-long bore the grade changes again, and we hurry downward through Penge and Kent House to Beckenham Junction. Between the last two stations some important engineering work is now being carried on, including the raising of two underline bridges and the realignment and regrading of the tracks, which will enable the service slack hitherto enforced here to be cut out. This will be an advantage, as the rise beyond Beckenham will then be taken "at a run," and time economised.



Courtesy] [*Southern Railway*

The fine lattice-girder bridge, by means of which the "*Kent Coast Express*" crosses the Medway at Rochester. The photograph was taken from the top of Rochester Castle

Soon after passing Shortlands the 1 in 100 ascent recommences, and continues on through Bromley to Bickley. Here, at Bickley Junction, we part company with the electrified lines, which diverge to the right for Orpington Junction, where they join the old South Eastern main line on its way from Charing Cross to Folkestone. Now that he has got clear of the congested suburban zone the driver doubtless feels that he can breathe more freely, and so he "opens out" over the switchback, though easier, length to Sole Street.

We may have taken from 25 to 27 minutes for the first 14 miles to Bickley Junction, but it is possible at last to get into speed. We swing down the short descent to St. Mary Cray, touching for the first time 60 miles an hour, and slightly exceeding this rate, probably. Then we climb to Swanley at a minimum of about 50, and develop some high speed on the falling grades thence to Farningham, reaching from 70 to 73 miles an hour here. From Farningham we have to rise steeply to Meopham, passed at about 45 miles an hour; and then, at Sole Street, we are faced with the worst bank on the route. Fortunately it is in our favour—its four miles right off at 1 in 100 is a serious handicap for up trains—but owing to its winding character, we cannot take proper advantage of it, and over most of its length we shall run at under a mile-a-minute. Down the lower part of the bank a magnificent view opens up on our right of the winding reaches of the River Medway, with the great Portland cement works that line its banks.

Photograph] [*Railway Photographs, Liverpool*

The down "*Margate Express*" passing through the outskirts of London. The locomotive is one of the 4–4–0 "L" class, No. 489. Note the upper quadrant signal in the background

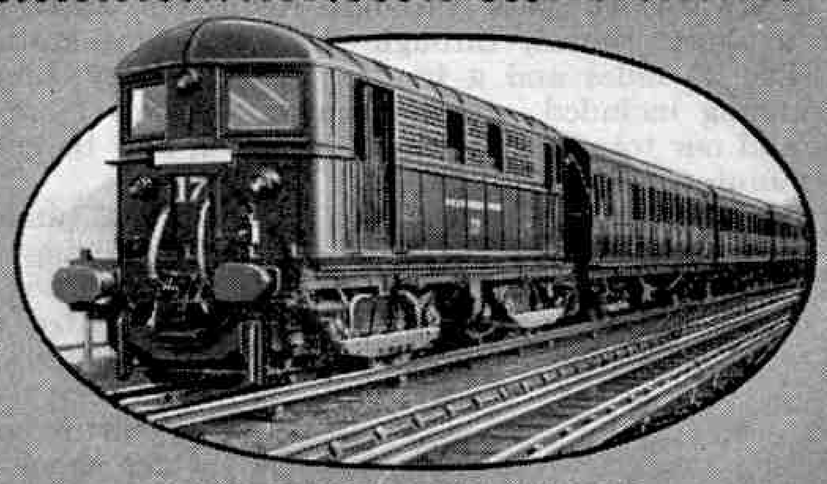
We now bend round to the right by a long and very sharp curve, with Rochester Castle here a prominent object above the opposite river-bank, as a preliminary to crossing the Medway by a fine lattice girder bridge of considerable size. Speed is reduced to about 20 or 25 miles per hour for the curve. Immediately afterward we pass through Rochester Station and then, after a short tunnel, through the important station of Chatham. The 20 miles and a fraction from Bickley Junction, this slow running included, will not have taken us more than 25 minutes, and our total time from Victoria will now be between 50 and 52 minutes.

Rising gradients again lie ahead, at first through tunnel, to Gillingham, and then on to Rainham, after which we get a short and steep descent to Sittingbourne, which should raise the speed to 65 an hour or more. Easy gradients continue on past Teynham and speed may rise further, if our driver is energetic, to 68 or 69 m.p.h., before we begin to breast the rise that precedes Faversham. This is climbed at a minimum of about 50 miles an hour, and then we have to slow severely, as the Margate route diverges sharply to the left just after Faversham Station. It is all but 18 miles from Chatham to Faversham, and with a good engine and driver 20 minutes should suffice.

For many miles along the Kent Coast the line is practically level, the only rise of note being over the ridge on the end of which Herne Bay has been built. Before reaching this, which entails an ascent partly at 1 in 100 and will pull our speed down to about 45 miles an hour, we have run for some miles at 60. The subsequent descent should afford us a final spurt at 68 to 70, ere we sight Westgate, the western suburb of Margate. Presently we draw up in the fine new station at Margate, the last 22 miles having taken us 24 or 25 minutes. We have just about a minute in hand, and have made an excellent run over a most difficult road.

Both at Margate and at Ramsgate the Southern Railway management have followed the most commendable policy of concentrating their traffic—previously arriving on different lines and dealt with at different stations—at central and well-equipped through stations. This has involved considerable constructional expense on new buildings, and new tracks to link up the old routes, but the result has been most beneficial—to the public by improved service and better connections, and to the railway by the reduction of staff and expenses that follows on concentration.

We can travel on to Ramsgate by the "*Kent Coast Express*" if we so desire. It is 5½ miles away, and the heavy intermediate gradients, with the length of stops involved at Broadstairs and Dumpton Park, prevent an earlier arrival at Ramsgate than 5.14 p.m., practically two hours after leaving Victoria. I have a better plan for you, however. Get out at Margate, and wait for the up "*Kent Coast.*" It is due just before half-past five, and leaving Margate on the stroke of 5.30 p.m. will give you a non-stop run back to town in 100 minutes, bringing you into Victoria at 7.10 p.m., and thus completing your round trip in less than four hours.



A METROPOLITAN TRAIN

RAILWAY NEWS

G.W.R. Locomotive News

Nine new 4–6–0 Hall class passenger locomotives have recently been put in service and are numbered as follows:—4926, *"Fairleigh Hall"*; 4927, *"Farnborough Hall"*; 4928, *"Gatacre Hall"*; 4929, *"Goytrey Hall"*; 4930, *"Hagley Hall"*; 4931, *"Hanbury Hall"*; 4932, *"Hatherton Hall"*; 4933, *"Himley Hall"*; 4934, *"Hindlip Hall."*

Three new 0–6–0 tank locomotives, Nos. 5758-60, are the latest tank goods engines to be put in service.

The contract for building 100 six-wheeled coupled tank locomotives has been equally distributed between the North British Locomotive Co. Ltd., of Glasgow; The Yorkshire Engine Co., Sheffield; Kerr, Stuart and Co. Ltd., Stoke-on-Trent; and W. G. Bagnall Ltd., Stafford.

Steel Containers for L.N.E.R.

The Metropolitan-Cammell Carriage, Wagon and Finance Co., of Saltley, Birmingham, have recently received an order for 230 steel containers for the L.N.E.R. It is understood that a number of these will be fitted with flat tops and the others with shelves.

Proposed Tube Railway for Calcutta

The Railway Board of the Indian Government are having plans prepared for a tube railway through the centre of Calcutta, to enable suburban passengers to be conveyed to a central tube station at Dalhousie Square without changing trains at Sealdah or Howrah. This scheme is to be put forward in conjunction with the proposed electrification of the suburban lines of the East Indian and East Bengal Railways, and it is estimated that it will cost £4,000,000.

New Rail Car for L.M.S.

The L.M.S. have placed on order for a 100 h.p. Sentinel-Cammel geared steam rail car, with luggage accommodation and seating capacity for 44 passengers. This car is similar to the one that has been undergoing experimental trials on this company's system for the last few months at Hamilton, Glasgow.

A "Menagerie Special"

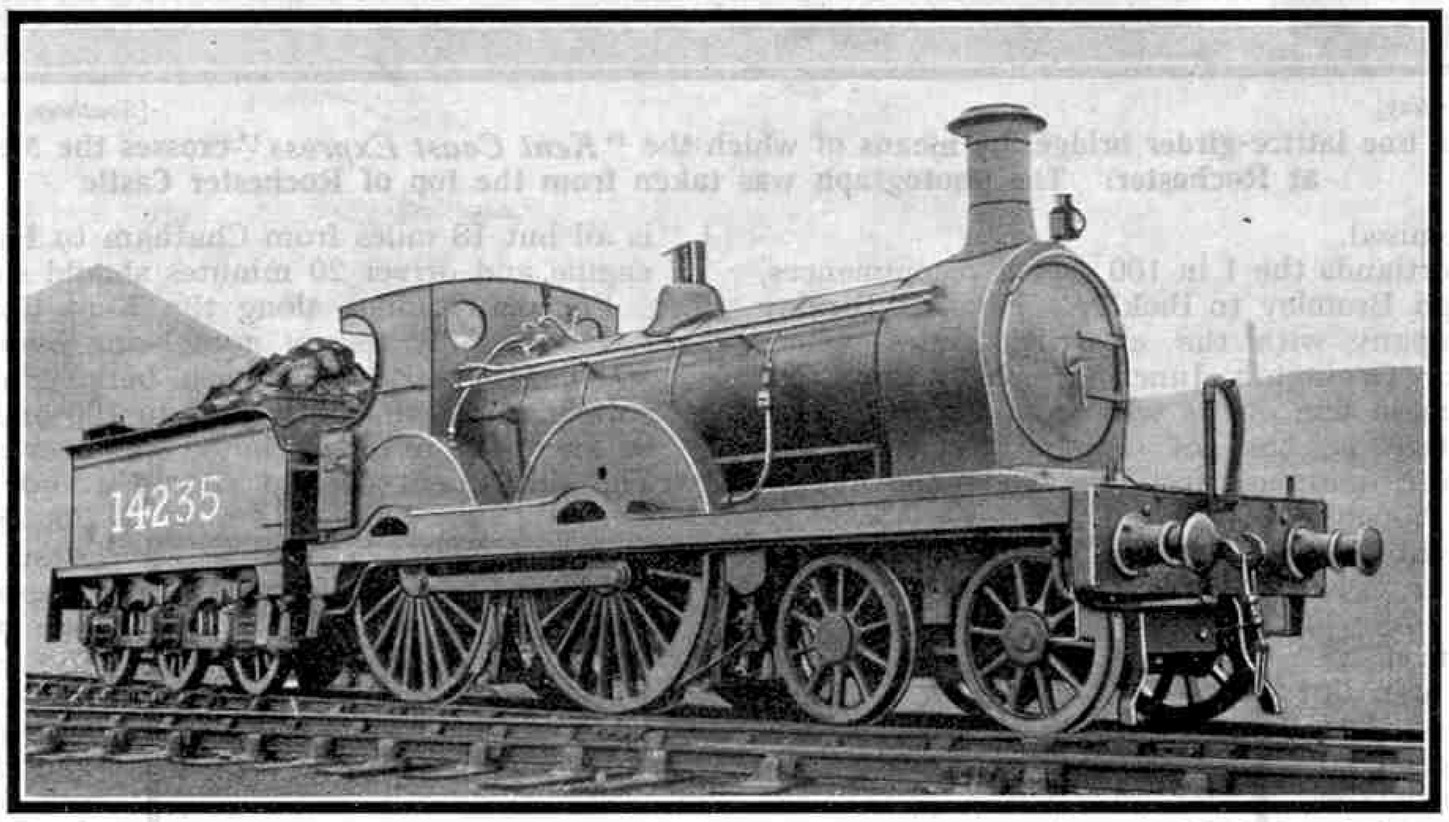
The Great Western Railway recently conveyed by a special train a complete menagerie from Newquay (Cornwall) to Salisbury. The train was composed of sixteen "crocodiles," two "pythons," and "two scorpions," these being the railway terms by which the vehicles forming the main part of the special train are known. The two python wagons had to be strengthened in order to convey the elephants. The large size of some of the wagons necessitated a special route being followed by the train, for both lines had to be kept clear during its passage.

The train left Newquay at 6 a.m. and arrived at its destination at 6. p.m. Its speed did not exceed 30 miles per hour, and stops had to be made every 50 miles in order to feed the animals and to permit other trains to pass. To load and unload this strange consignment special travelling cranes were sent to Newquay and Salisbury, and the passage of the train was signalled from box to box by a special call signal.

The composition of the train was as follows:—three trucks bears; one truck leopards; one truck lions; one truck tigers; two trucks monkeys; one truck birds; one truck monkeys and pumas; one truck kangaroos, apes and hyenas; one truck zebras; two trucks elephants, and one truck llamas and ponies. In addition there was one passenger coach conveying trainers and attendants, and vehicles carrying tractors, caravans and general menagerie equipment.

Air Brakes on Belgian Goods Trains

The administrative council of the Belgian National Railways have approved the draft contract for the supply of air brake apparatus in place of the hand brake at present in use on the freight trains. It is understood that the Westinghouse Company are to supply a large amount of the apparatus, the remainder being obtained from Germany under the Reparations account.



Photo] [*J. J. Cunningham*

READY FOR WORK. Our photograph shows L.M.S. locomotive No. 14235 (G. & S.W. Section) coaled in readiness for the hard day's work. Readers will notice the position of the safety valves in the centre of the boiler

Railway Signalling in New South Wales

The whole of the six-track section between Sydney and Homebrush, N.S.W., has now been equipped with colour light signals. The widening of this section to cope with the heavy traffic involved the rearrangement of the junctions at Strathfield and Homebrush, and the installation of large electro-pneumatic power signal frames at each of the stations. Automatic colour light signals and train stops have also been installed on the North Shore line between Milsoms Point and Hornsby, as this line has to handle very heavy suburban traffic. Though no signalmen are employed on this line, provision has been made for trains to terminate their journey at intermediate stations, the signals at these points being of the semi-automatic type.

New Expresses on Southern Railway

Before the War the regular timing of the expresses between Waterloo and Bournemouth was two hours, the train being composed of ordinary and fairly light rolling stock. This service was discontinued during the War, and not reinstated until 8th July of this year. The old type rolling stock has been replaced by a composition of modern corridor coaches, each train consisting of 10 vestibule vehicles, with a total weight of just over 330 tons.

The train is divided into three portions for Dorchester, Weymouth, and Wareham and Swanage. The trains leave Waterloo at 10.30 a.m. and 4.30 p.m., the latter being known as the *"Bournemouth Limited."* Similar "up" trains leave Bournemouth Central daily at 8.40 a.m. and 5.15 p.m.

Power Worked Level Crossing

An innovation in Australian signalling practice has been the installation of a set of interlocked crossing gates near Newcastle, actuated by compressed air. This crossing is a very busy one, for in addition to ordinary vehicular traffic there is a double tram track passing over the railway. It is understood that the gates have proved quite a success and the use of power is being advocated for other busy crossings.

L.M.S. Locomotive News

Referring to our notes in last month's "Railway News" on the new 0–8–0 Crewe built freight engines, it should be noted that No. 9524 is the latest to be put in traffic. Nos. 9500-4 are stationed at London, while the remainder are temporarily allotted to the Crewe South shed during their trials. Ten of these locomotives, 9510-9 are afterwards to be put in traffic on the L. & Y. section of the L.M.S.

The L.M.S. mixed traffic "Mogul" type locomotives Nos. 13110-3 are now painted black to agree with the latest L.M.S. locomotive livery colours. They are at present stationed at Crewe and are classified as 5P for passenger traffic, and 4F for freight service.

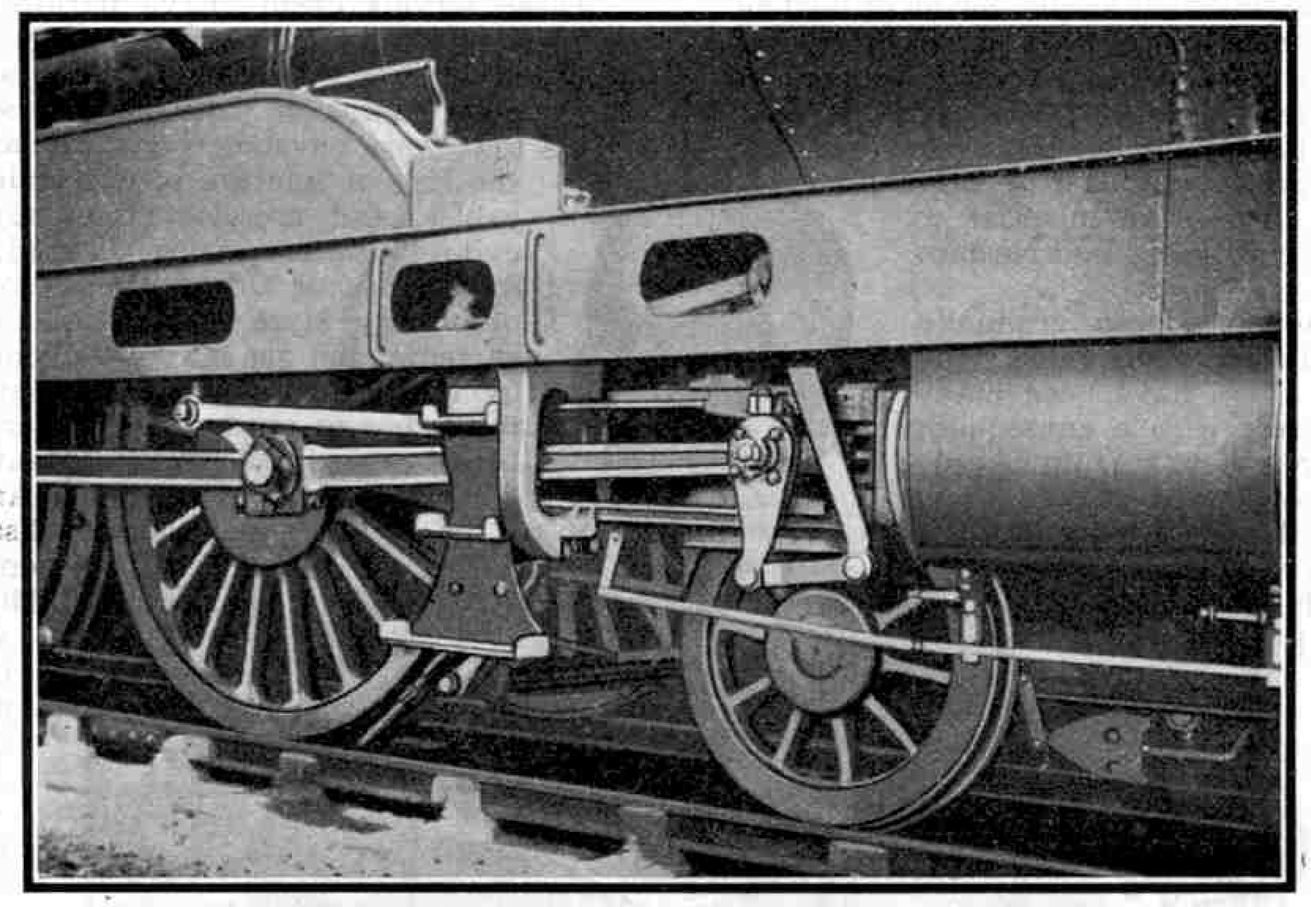
Extension of S.R. Electrification

The Southern Railway have authorised the expenditure of £597,000 on further extension of their electrical suburban system in the London district. The three new areas that are to be electrified are:—Hounslow Junction and Whitton Junction; Dartford to Gravesend and Wimbledon to West Croydon.

These alterations should be completed by the summer of 1930 and will provide a 20-minute service during business hours and 30-minute at other times. By the addition of these extensions the Southern Railway suburban electrified system will be increased by 800 track miles. It is interesting to note that this is the largest electric suburban system in the world. The superiority of electricity over steam for working suburban services is being appreciated by the travelling public, for last year 6,500,000 more passengers were carried than in 1927, and that year showed an increase of 11,500,000 over the previous year.

Head Codes on Southern Railway

Changes have recently been made to the head codes in use on some of the electrified sections of the Southern Railway. These are, we understand, in the nature of an experiment in the use of an alternative to the present system. We are unable to give any details until we learn definitely whether the present system of letters and numerals is to be retained, modified, or replaced by an alternative.



An interesting close-up view showing the details of the Walschaerts valve gear of a "Claughton" class locomotive

New Restaurant Trains on L.N.E.R.

Two new vestibuled restaurant car trains have been placed in service on the London-Norwich and Cromer route of the L.N.E.R. The composition of the trains is as follows:—First-class restaurant car and third-class saloon used as restaurant car; first-class corridor coach; four composite corridor coaches; four third-class corridor coaches and four corridor brake coaches.

The coaches are finished in standard L.N.E.R. colours and are all fitted with Buckeye automatic couplers. The interior of the first-class restaurant has rather a palatial finish, being panelled in polished mahogany and upholstered in green buffalo hide. The third-class compartments of the train have also received special attention, and the accommodation is all that could be desired.

The electric equipment, including cooking apparatus, has been supplied by J. Stone & Co. Ltd., and includes a large storage battery for supplying power when the train is at rest, and two axle-driven generators for use when travelling. Two exhaust fans are fitted in the roof for ventilation while between the kitchen and pantry there is fitted a refrigerator.

L.M.S. Record Run

A short time ago a special non-stop train worked by "Royal Scot" No. 6127, *"Novelty,"* travelled between Bussie, near Stirling, and Euston, a distance of approximately 416 miles, thus beating all previous world records for non-stop train journeys.

The previous record run of 401.5 miles was also held by the *"Royal Scot."*

Silver Anniversary of *"Cornish Riviera"*

The Great Western Railway have celebrated the 25th anniversary of the introduction of the *"Cornish Riviera"* express by equipping this famous train with new rolling stock consisting of 13 coaches. The coaches were built at Swindon, and differ in many respects from those at present in service. The length has been increased to 60 ft. and the width to 9 ft. 7 in. This extra width was made possible by reason of the Great Western Railway permanent way having been originally designed for broad gauge stock, and therefore it will not be possible for stock of this description to travel over the lines of other companies where standard 6 ft. way is adopted.

The coaches are mounted on steel underframes and are of fireproof construction. Improved couplings and buffer springs have been fitted to enable the train to move as a unit and so obviate surging at starting and oscillation when travelling at high speed.

The new train is designed with seating accommodation for 428 passengers, and for 119 diners at one sitting, there being room for 24 in the first-class car and 95 in the third-class car. The interiors of the first-class coaches are panelled in walnut, while the third-class have been finished in Honduras mahogany instead of the usual grained and varnished wood. The exteriors of the coaches are equally distinctive and are of a flush finish that is designed to reduce wind resistance to the minimum and also to provide a means for easily and quickly cleaning them. Even the door handles have received attention, for these are recessed into the sides of the coach and are chromium plated, as this finish is better able to withstand the weather than the brass surface. To render the dropping of windows unnecessary when opening and closing the doors, "slam" locks have been fitted.

The company have paid particular attention to the health of their passengers and have introduced Vitaglass into all their compartment windows. It is interesting to note that this glass has been utilised in a special compartment called the "sunshine parlour" on Canadian trains, but the *"Cornish Riviera"* passengers do not have to leave their compartments to get the full benefit of this healthful feature.

Unusual Railway Names

We have been amused, in reading some American railway magazines, at the slang terms used on U.S.A. railways. The following are examples:—General Manager—"Whiskers," Fireman—"Diamond Pusher," Telegraphist—"Lightning Slinger," Clerk—"Pencil Pusher," Railway Policeman—"Gum Shoe," Engine-house Foreman—"Mad-house," Yard-master's Office—"Knowledge Box."

DIFFICULTIES EXPLAINED

XII—Small Number Plates on the Rear of Passenger Coaches

On the ends of passenger coaches readers may have noticed a small number plate with the word "Seats," and underneath two numbers thus:—$\frac{12.}{50.}$ This indicates that there are first and third-class compartments in the coach, the upper figure referring to the number of first-class seats and the lower to the third. In the case of a third-class coach, the numbers would be arranged $\frac{0}{80}$ while a first-class coach would be $\frac{60}{0}$, the actual figure, of course, depending upon the seating capacity.

An Automatic Sentinel

Instrument That Reports Underground Gas Leaks

ONE of the most striking features of the past century has been the enormous development of engineering schemes in connection with the growth of towns, having for their object the providing of an adequate supply of gas, electric current and water, and at the same time ensuring ample means of dealing with sewage. These developments have necessitated the provision of miles and miles of pipes and conduits, which for general convenience have been laid underground. The result is that beneath the large towns and cities of to-day lies a vast network of pipes, the intricacies of which are so great as to demand the keeping of charts of their disposition in order to prevent any of them from being overlooked and perhaps even completely forgotten.

During recent years the fact has been gradually forced upon us that these underground pipes may become a source of danger. There have been many instances of water mains bursting, with a consequent discharge of water of such violence as to tear up heavily paved streets. A danger more serious still lurks in the mains that carry municipal gas supplies. Minor trouble with gas mains has been experienced for a considerable time, but the extent to which the danger might develop has not been brought home to us until quite recently. The increase in the weight of traffic passing along the streets of busy towns appears to have had a very injurious effect on the gas mains, particularly the older ones, and leaks have gradually developed. In many cases these leaks have not been immediately detected, and the escaped gas has collected in pockets and cavities of the ground, in sewers, and in the conduits that carry the cables for electric light and power or for telegraph and telephone services—in fact, in any available recess. The presence in the air of as little as seven per cent. of gas is sufficient to make it just explosive, and thus a very small leak may lead in a short time to a dangerous situation. In extreme cases, conditions in the underground tunnels may become as dangerous as those in a " fiery " coal mine.

Photographs courtesy] [*W. R. Patents Ltd.*

The inventor, Mr. H. T. Ringrose, B.Sc., with two types of his Fire-damp Alarm. In the one on the right the red lamp that gives warning of the presence of explosive gas is clearly seen. When fire-damp accumulates the light appears within a few seconds.

When gas has accumulated to a sufficient extent, any spark or naked light may cause a violent explosion. A workman examining or repairing cables may strike a match; a fuse may occur in an electric cable; or a burning match may be thrown down the manhole of a sewer—any one of these acts is quite sufficient to bring about widespread disaster.

The havoc that may ensue as the result of the firing of an accumulation of underground gas was shown just before Christmas of last year, when an explosion occurred near the manhole of a sewer in a London thoroughfare. Gas had accumulated in long stretches of sewer on both sides of the manhole, and the flame of the explosion passed along these at tremendous speed. The underground disturbance was of such violence that paving stones and manhole covers were hurled into the air; motor cars and other vehicles were lifted off the ground and overturned; while foot passengers were flung violently in all directions and many were seriously hurt. After the explosion the district looked as if it had passed through a violent earthquake, or had been thoroughly shelled!

Perhaps the most disquieting feature of the affair was the impossibility of knowing when and where the danger would end. For a considerable time there was risk over a large area of further explosions or outbreaks of fire. Other disastrous fires did, in fact, break out, and the gas and water supplies of the entire district were completely cut off.

These serious events have naturally caused considerable uneasiness, for beneath the streets of every large town or city there exist on a smaller scale conditions similar to those in London. Continuous vibration caused by passage of heavy traffic over roads that were never designed to carry it has greatly increased the risk of fracture of gas mains and distortion of electric cables, and therefore the danger of explosions must inevitably be increasing. In addition, the great expansion in the use of electricity has resulted in the laying down of a very large number of cables carrying high voltage currents, and gas mains are being eroded to a serious extent by the electrolytic action of stray currents. These punctures due to erosion must therefore be added to the fractures caused by traffic vibration.

Various means of preventing further underground disasters have been considered, and of these only two appear to be at all practicable. The first is to dig up the streets under which conditions are likely to be bad, and to replace entirely any old or defective gas mains. This probably would be a satisfactory remedy, at any rate for a time, but it would be so costly as to be almost out of the question. The other method of dealing with the problem is that of detecting the presence of escaped gas before it has time to accumulate in explosive quantities, and then dispersing it harmlessly. Fortunately this may now be done in a remarkably simple but ingenious manner by means of an apparatus known as the " Ringrose Gas Sentinel," the invention of Mr. H. T. Ringrose, who has devoted many years to the study of methods of detection of fire-damp, the explosive gas met with in coal mines.

Fire-damp has been responsible for many appalling explosions, most of which were caused by the flames of the candles or oil lamps formerly used by miners. The danger became particularly acute a little over a century ago. Before that time only those coal seams that were near the surface had been worked, and consequently little trouble had been experienced with outbursts of gas. Then seams at greater depth were attacked and, as the shafts were sunk lower and lower, the conditions became more dangerous. Rushes of fire-damp from the coal face were experienced, and the gas was readily ignited by the naked lights used by the miners in the early days of the industry.

In spite of all precautions, disastrous explosions occurred with appalling frequency. For instance, one occurred in 1812 in a pit near Gateshead, in which 90 men and boys were either suffocated or burned to death; and in the same pit in the following year a similar accident resulted in the death of 22 men and boys. Some of the more dangerous pits were abandoned entirely, and all kinds of expedients were resorted to in other pits in order to reduce the danger to the workers. The state of affairs was well summed up by a friend of George Stephenson named Heppel. An alarming fire had occurred at the Killingworth pit where both men were employed, and Heppel asked: " Can nothing be done to prevent such awful occurrences? " In reply Stephenson expressed

the opinion that something might be done. "Then," said Heppel, "the sooner you start the better, for the price of coal mining now is pitmen's lives!"

Many efforts were made to make the mines safe by better ventilation, but it was soon found to be impossible to drive the fire-damp away with sufficient speed to prevent explosions. It came to be realised that the only hope of safety lay in the provision of some means of illumination other than that by naked lights. Electric light was then unknown, and at first the problem seemed quite hopeless, as may be imagined when it is stated that in certain mines the phosphorescence of decayed fish skins was tried! This light was certainly safe, but, of course, utterly inefficient.

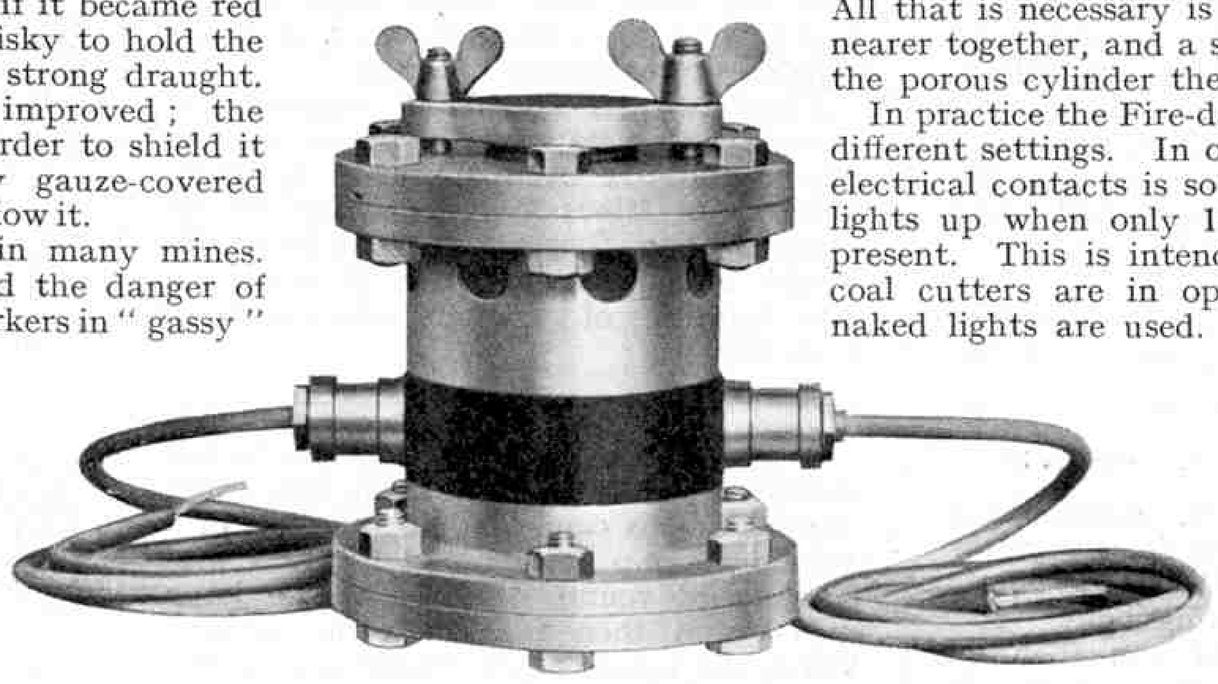
It was in these circumstances that George Stephenson on the one hand, and Sir Humphry Davy on the other, tackled the problem of producing a safety lamp. Both men made the discovery that the flame of an explosion would not pass through very small apertures. Stephenson was the first actually to produce a lamp operating on this principle, but it was left to Davy to put the matter on a thoroughly scientific basis and ultimately to produce a lamp of the highest efficiency. In his lamp Davy surrounded the flames with wire gauze having about 800 openings to the inch. This did not prevent fire-damp from reaching the flame, but the cooling effect of the gauze prevented the ignition of the gas in the surrounding atmosphere. The lamp gave a reasonable amount of light, and thus at one stroke the risk of explosions was reduced to such an extent that work was re-commenced in mines that had been abandoned as hopelessly dangerous.

The parts of the Ringrose Fire-damp Alarm. In the upper row are the battery and the sections of the case, and on the right of the bottom row are the working parts of the Alarm. The porous cylinder may be seen below the lamp

Davy's lamp also was useful as a means of detecting fire-damp. This gas burns with a curious blue flame, and the appearance of a "blue cap" inside his lamp not only warned the miner that fire-damp existed in the atmosphere in which he was working, but also enabled him to judge approximately the proportion present.

The miners' lamp thus developed was not absolutely safe, for the gauze ceased to be effective if it became red hot. For this reason it was very risky to hold the lamp at an angle or to use it in a strong draught. Later patterns were very greatly improved; the flame was surrounded by glass in order to shield it from draught, and the necessary gauze-covered apertures were placed above and below it.

To-day electric lamps are used in many mines. These lamps have greatly decreased the danger of explosions, but even yet the mine workers in "gassy" pits run risks, for fire-damp may be ignited during shot firing or by accidental sparks. Electric lamps are safe and give sufficient light, but they suffer from the serious defect of giving no warning of the presence of fire-damp. Mr. Ringrose tackled the problem of producing an electric lamp that would show that gas was present, and he has succeeded in making a Fire-damp Alarm that automatically displays a warning sign when the proportion of gas in the atmosphere of a mine passes the safety point.



The Gas Sentinel that automatically gives warning of accumulations of gas in underground conduits. It differs from the Fire-damp Alarm only in having the lamp and battery removed to a distant point above ground

When the explosions in London drew attention to the dangerous conditions underground, Mr. Ringrose realised that they were exactly the same as those obtaining in dangerous pits, and that his electric Fire-damp Alarm was capable of detecting escapes of coal gas from broken or otherwise defective mains. He made slight modifications to his apparatus with the result that the new alarm, which he calls the "Ringrose Gas Sentinel," is actually capable of telephoning to the nearest exchange the news of any leak that it has detected! Not content with this, it also sets in motion a fan that disperses the gas and automatically stops the fan when the danger of explosion has been averted. Finally the alarm sends above ground an "all clear" message, and then settles itself down again to continue sentry duty!

On page 684 is a drawing that will help to explain the simple but ingenious manner in which the Fire-damp Alarm works. The circuit of the "Gas Sentinel" differs from that of the Alarm only in minor details.

The most important part of the apparatus is a small porous cylinder of unglazed earthenware. This is made of the same material as the porous pots to be seen in the Leclanchè cells commonly used to operate house bells. The cylinder is clamped tightly between two metallic plates, and inside it is a filament or thin wire, which is heated by current from a small battery. Air passes slowly through the minute pores of the pots, and any explosive gas that is mixed with it burns as soon as it comes into contact with the glowing wire. The flame cannot pass through the pores of the unglazed earthenware, and the lamp is therefore perfectly safe for use in a "fiery" mine.

One of the products of the burning of fire-damp is water. This is produced as a vapour, but it very quickly condenses to a liquid, which takes up much less room than the steam from which it is formed. The pressure inside the porous cylinder is thus reduced, and the Ringrose Fire-damp Alarm makes use of this in order to close an electric circuit that lights a red lamp when a certain proportion of fire-damp is present. The reduction in pressure inside the porous cylinder is communicated through a narrow tube to a small drum, the sides of which are flexible and are forced inward by atmospheric pressure when the inside pressure is reduced. This movement brings two terminals into contact with each other and completes an electric circuit that causes the red lamp to light up. Thus the presence of explosive gas is made to show itself in a manner that is quite unmistakable.

An interesting point is that the lamp may be made to show the presence of gas before the proportion has reached a dangerous stage. All that is necessary is to set the points of contact nearer together, and a smaller fall in pressure inside the porous cylinder then brings them into contact.

In practice the Fire-damp Alarm is made with two different settings. In one the distance between the electrical contacts is so adjusted that the red lamp lights up when only $1\frac{1}{4}$ per cent. of fire-damp is present. This is intended for use where electrical coal cutters are in operation, and in pits where naked lights are used. In other circumstances an alarm that lights up in the presence of $2\frac{1}{2}$ per cent. of fire-damp gives ample protection, for the warning light appears in 35 seconds or less from the time when the percentage of explosive gas for which it is set has been reached.

One of the greatest merits of the invention is that it is always on duty! Formerly, tests for the presence of gas could only be made at intervals, and conditions in mines change so quickly that between successive inspections there was always a danger of a serious explosion. Where the alarm is installed, there are no intervals when the mine-worker is unprotected from his greatest enemy.

In its latest form the Ringrose Fire-damp Alarm is made part of a miner's electric lamp. In this there are two bulbs, one of which gives the necessary light, while the other is coloured red and under ordinary circumstances remains unlighted. In pits where these lamps are used every mine-worker carries his own

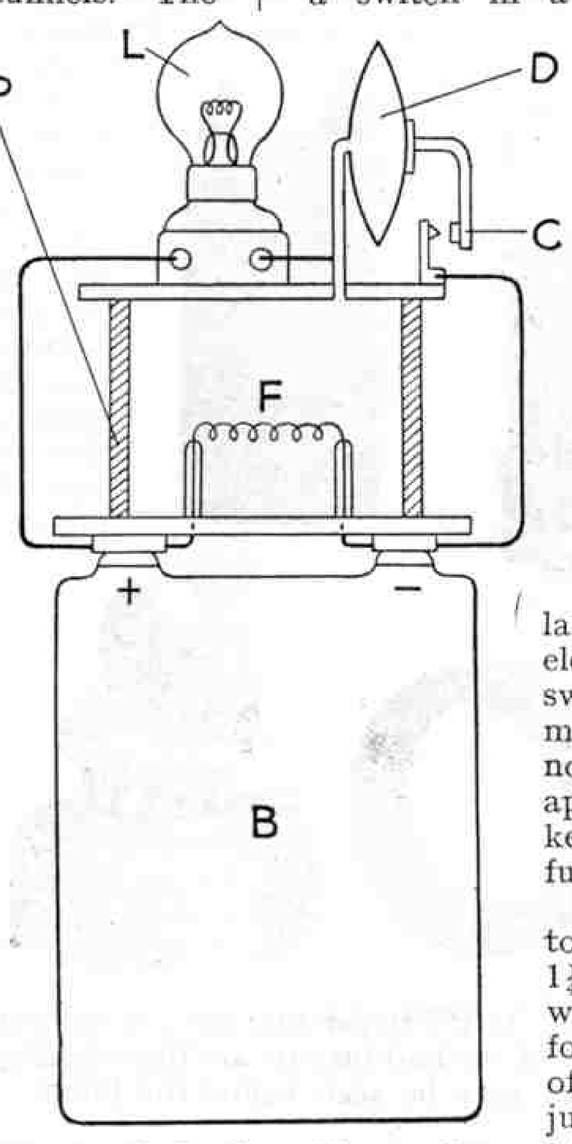
fire-damp detector, and the appearance in his lamp of a brilliant red light that cannot be overlooked warns him immediately of any sudden rush of gas from the coal face.

Now let us see how the inventor has adapted his Fire-damp Alarm to the new problem of the detection of gas in sewers and other underground tunnels. The essential part of the apparatus requires no alteration whatever. Coal gas passes through a porous pot and burns when it comes into contact with the hot filament, in exactly the same manner as fire-damp. A similar fall in pressure also takes place, for water is one of the products of combination of both gases. A Fire-damp Alarm in an underground conduit would therefore show the presence of explosive gas just as easily as it shows the presence of fire-damp in a coal mine.

In such a situation the instrument would remain unobserved for long periods, however, and therefore a new form was designed in which the warning lamp is removed to the nearest telephone exchange. Telephone and telegraph wires are very numerous in the conduits under our streets, and thus very little difficulty would be experienced in connecting the filament of the detector with a battery and lamp in the exchange.

In the new form of the instrument the current from the battery in the exchange passes through the filament, and is then led through the drum to one of the electrical contacts. Normally these touch each other and the circuit to the lamp in the exchange is completed through them. So long as explosive gas is not present, therefore, the lamp is lighted, but a reduction in pressure inside the drum due to the presence of gas around the Sentinel causes the contacts to open, with the result that the lamp goes out.

It will be seen that the action of the Gas Sentinel has been made the opposite of that of the Fire-damp Alarm. In the latter, warning is given by the lighting up of a red lamp, but in the case of the Gas Sentinel the warning sign is the absence of light.



How the Fire-damp Alarm works. Explosive gas passing through the porous cylinder P is ignited by the electrically-heated filament F, and the fall in pressure inside the drum D then completes the circuit through the red lamp by bringing together the electrical contacts shown at C

One reason for arranging the circuit in this manner is that it enables a fan to be brought into operation. This is placed alongside the Gas Sentinel, together with a switch in a second electrical circuit containing the fan motor. The switch is held open by an electro-magnet that is operated by the current passing through the filament. If current fails owing to the presence of gas, the switch closes, and the fan begins its task of dispersing the gas. When this has been done the pressure inside the porous cylinder becomes normal once more, and the electrical contacts above it are closed. This causes the lamp to light up, and the electro-magnet to open the switch controlling the fan motor. Thus the Sentinel not only carries out its appointed task, but also keeps the telephone exchange fully informed of its progress!

The Gas Sentinel is set to show the presence of 1¼ per cent. of gas. This is well below the danger point, for air containing 7 per cent. of escaped coal gas is only just explosive. The invention requires no further attention except the renewal of the filaments and similar slight adjustments from time to time. It continues to work in silence, and as long as the filament is lit it is always on the alert for escaping gas.

If any fault develops in the signalling circuit the light immediately goes out, and thus the instrument sends word to the watchers at the exchange when it is not capable of remaining on duty!

The "*Ringrose Fire-damp Alarm*" has already shown its value in protecting the miner, and has been approved by H.M. Ministry of Mines for general use underground. The Gas Sentinel undoubtedly would be equally effective in detecting accumulations of gas under the streets of large cities.

How to Get More Fun—(*Cont. from page 725*)

showing "N" will then be extinguished for about three seconds while the motor throws over the points. When the points are fully over the indicating light "R" will be lit, and the lever can then be pulled over to full reversed position. If there is anything wrong with the setting of the points no light appears in the indicator when the lever is in the "mid" position.

It is impossible to reproduce this electrical working in its entirety on an ordinary model railway, but light indications indicating wrong setting of points may be installed without difficulty. In order to do this it is necessary first to insulate the long curved rail of the points leading to the branch line or sidings. The guide rod beneath the movable plate of the points should be insulated by a short length of narrow insulating tape.

A wire is taken from the battery to the insulated rail; another from the other running rail is connected to the base of a Meccano Lamp Socket, and finally a wire is wrapped round the side of the lamp socket and then taken to the battery. When the points are correctly set for the main line the lamp will be lit, but if the points are not set correctly there will be no light.

New Locomotives of the Hornby Series—

(*Continued from page 731*)

The last of the four models is a reproduction of one of the Southern Railway "L" type, No. A759. These locomotives are of the highest efficiency and are used to haul some of the continental boat trains from Victoria to Dover, in addition to other express services where good time-keeping over a heavy route is required.

OUR MAIL BAG

In this column the Editor replies to letters from his readers, from whom he is always pleased to hear. He receives hundreds of letters each day, but only those that deal with matters of general interest can be dealt with here.

Correspondents will help the Editor if they will write neatly in ink and on one side of the paper only.

G. H. Giles (Birmingham).—We think you must feel very glad now that you did not part with your "*M.M's*". We receive many letters from readers telling us how highly they value their bound volumes, and the continued pleasure they obtain from them.

Mr. O. Holden (Bradford).—It is quite evident that the kitten that destroyed your son's competition entry form does not realise that Meccano contests are very serious affairs! It is the first time we have heard of such an occurrence, although we know of a kitten that takes a wicked delight in upsetting a box of nuts and bolts and distributing the contents all over the floor!

Mr. W. A. Gambie (London, S.W.11).—We are glad to assure you that there is no immediate prospect of Mr. Allen's articles coming to an end. Their popularity seems to increase with every issue. We hope to have other articles on similar lines to the one on panchromatic photography that interested you so much.

P. Essex-Lopresti (Warley Hill).—Your suggestion for more advanced articles is very interesting, but we are afraid that it is scarcely practicable without introducing technicalities that would not appeal to our younger readers. At the same time we are always ready to consider suggestions for any particular article or type of article.

R. Ellis (Waterford).—You will be glad to know that the Hornby Railway Company is growing rapidly day by day, and new Branches are being formed in all parts of the country. We have some good articles on electricity in progress. If you are interested in any special electrical branch please let us know.

W. Livingstone (Dalbeattie).—"I have been a steady reader of the "*M.M.*" for four years, and hope to continue reading it for another 44"! We wonder how many pages the "*M.M.*" will consist of by that time! We are glad to hear that your father finds the "*M.M.*" useful, and that he falls back on "*Fireside Fun*" when he requires an original joke.

Mr. I. Takahashi (London, S.W.17).—We are glad that you like your prize, "*Engineering for Boys*," and we wish you success in other "*M.M.*" contests. Many of our Japanese readers write to us regularly, and we hope that you will do the same.

G. Jarrett (Clevedon).—Your suggestion for a whole page of engineering photographs each month is quite interesting, and we shall give it careful consideration. We do not think we can spare any more space for "*Readers'*" articles at present. All interesting articles submitted for these pages are given careful consideration; so send along one of your own.

L. Fisher (Johannesburg).—We are afraid that even yet our modesty will not allow us to reproduce a portrait. We quite realise your "agony of mind," but possibly if you saw the portrait you might be in a worse state than ever! We wish to reassure you on one or two points, however. We are not "a stout, bald, old gentleman," nor are we yet "perfectly spherical," although there appear to be slight tendencies in that direction! Send another cheery letter soon.

Miss V. T. E. Davey (Liskeard, Cornwall).—Your enthusiasm for Meccano is quite refreshing. We were grieved to hear that the mouse your brother caught for you in a Meccano trap had departed this life; what surprised us was your anxiety to possess a live mouse. So far as we know, most girls have no yearnings in this direction! Your suggestion for articles on music will have careful consideration.

Mr. C. S. Helps (Bristol).—We were extremely interested to hear how you became a Meccano enthusiast—"In 1913 I was on a job that was a heavy strain on my mental equipment. I started to show signs of collapse so I went to a doctor. After a lot of questions he prescribed a set of Meccano, to be played with for two hours daily! It worked and I have never really given it up." We think this is a unique testimonial.

J. G. Guanadurai (Puthur, Trichinopoly).—It is quite in order for a reader to submit as many entries as he likes to any competition except voting competitions, in which one entry only is allowed. In any case, no reader may win more than one prize in one competition. We wish you good luck with your entries.

A Carillon as New Zealand's War Memorial

WHEN the subject of war memorials is mentioned one automatically thinks of a solid-looking stone monument of some kind, suggesting by its air of permanence the undying memory of those who fell in the War. New Zealand has decided to perpetuate the memory of its heroes in an entirely different manner by means of a magnificent carillon, the first of its kind in the Dominion, and one of the finest in the world.

The bells, of which there are 49, are cast in an alloy of pure copper and tin. The range in size is enormous, the largest weighing 5 tons and the smallest only 9 lb. ! The total weight of the 49 bells is 31½ tons. The accompanying photograph illustrates in a striking manner the massiveness of the bells, and also of the supporting frame, which itself weighs 34 tons and is constructed to carry 53 bells. It is intended later to add four bells to complete the number, and the largest of these additional bells will weigh 10 tons.

The bells are tuned on what is known as the five tone harmonic principle, whereby each bell is in tune with itself as well as with the others as a whole. The subject of bell tuning is a little complicated, but it may be said that the five principal tones in each bell are the Strike Note ; the Hum, an octave below the Strike Note ; the Nominal, an octave above ; the Tierce (third), and the Quint (fifth).

The clavier for hand operation by a carillonneur has a range of 4¼ chromatic octaves, the lowest 25 keys being attached to pedals as well as to the manuals. The clappers of the big bells are counterbalanced to ease the work of the carillonneur on the " heavy end," and the tracker work of the rollers and the intermediate cranks is of the latest design, embodying several improvements to ensure accurate striking of the bells and delicacy of touch on the little trebles.

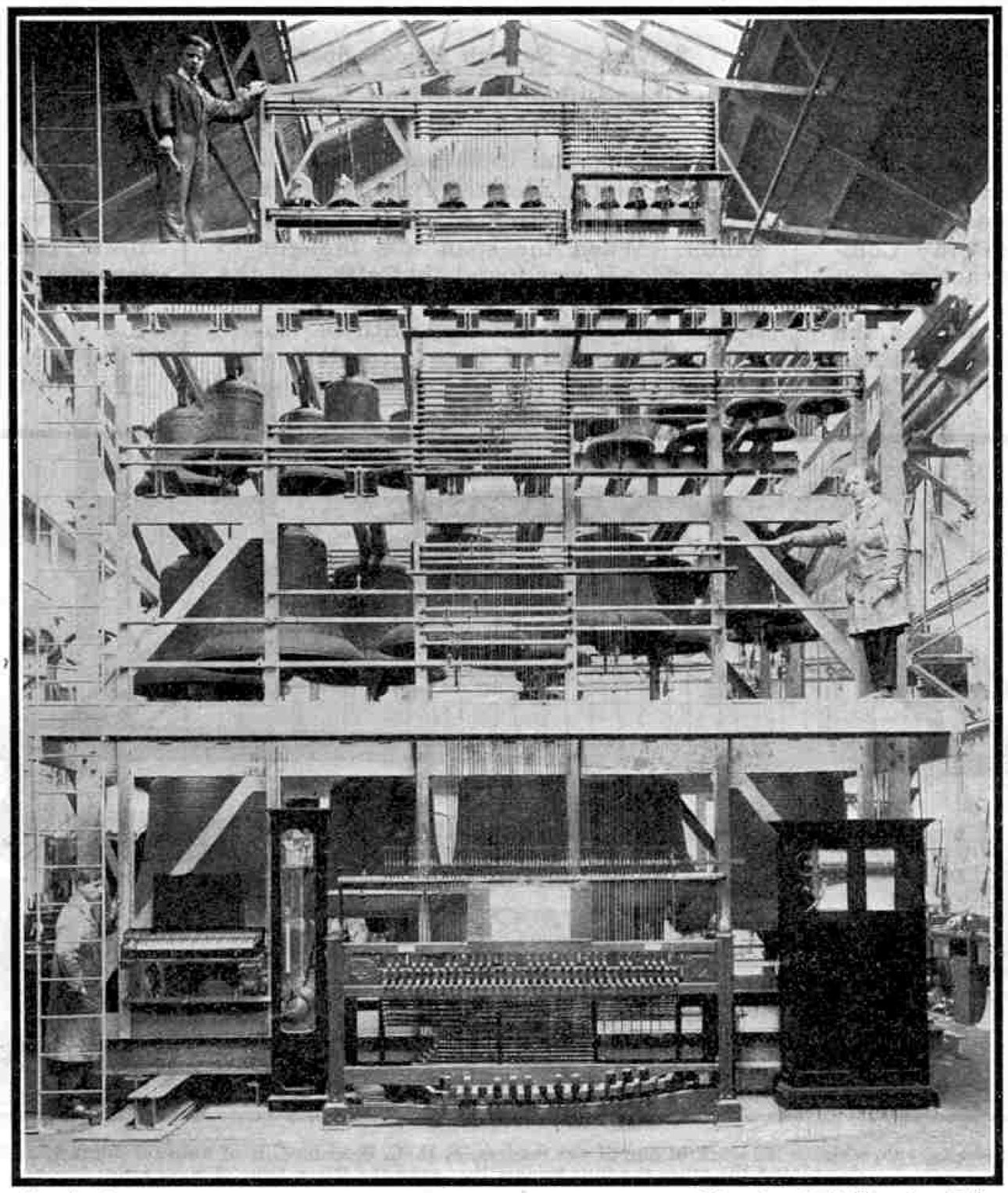
In addition to the clavier there is attached an electro-pneumatic mechanism patented by the makers of the carillon, Messrs. Gillett and Johnston of the Croydon Bell Foundry. This mechanism has a dual function. In the first place it operates a paper band machine on the principle of a player-piano, whereby tunes specially arranged for carillon music are played, the mechanism being released by a clock at any intervals desired. Secondly, the mechanism connects an ivory keyboard similar to that of a piano. This can be fixed in any part of the tower in which the carillon is erected, for use by musicians who are not carillonneurs.

Every bell in the carillon has been given by individuals or groups of people, and each one is inscribed with the name of some battle or engagement.

When the carillon is erected in New Zealand it will carry to the Dominion an art that has been developed chiefly in Holland and Belgium, where these instruments are more numerous than in all other countries combined. The lofty belfries of the magnificent cathedrals and churches of the Netherlands seem to be specially adapted to them, and carillons and chimes have been exceedingly popular there for more than 400 years.

The task of climbing the hundreds of steps that lead to the bell room of a typical belfry in the Low Countries is no light one. At Ghent it has been made easier by the installation of an electric elevator in which visitors quickly ascend to the room in which the 52 bells of the carillon are hung. These are arranged in a similar manner to that shown in our illustration. The smallest is 8 in. in diameter and weighs less than 18 lb. The largest just clears the floor of the room. Its diameter is nearly 7 ft., and its weight is six tons—four tons less than that of the largest of the four that will complete the New Zealand carillon.

The great bell at Ghent is famous for the part it has played in the history of the city. It is distinguished by an appropriate inscription, which runs as follows :— " My name is Roland ; when I toll there is fire ; and when I ring there is victory in the land." The bell was made in 1314, and in 1659 it was re-cast on account of a crack that had developed.



Courtesy] [*Croydon Bell Foundry Ltd.*

The magnificent carillon of bells that forms New Zealand's War Memorial. At the present time the carillon consists of 49 bells, ranging from one of 9 lb. to one of 5 tons in weight, and this number is to be increased later to 53. The largest of the four additional bells will be 10 tons in weight

Engineering News

New Thames Bridge Scheme

A scheme to relieve the existing traffic congestion around the Strand and Charing Cross area, London, is at last taking definite shape. A provisional agreement has been arrived at between the London County Council and the Southern Railway Company providing for the construction of a new road bridge across the Thames at Charing Cross. The scheme includes the demolition of the present Charing Cross station and hotel and the erecting of new premises on the south side of the river. The site approved for the erection of the new station and hotel is a triangular riverside area extending from the existing Charing Cross bridge to Waterloo bridge, and is considerably larger than the site occupied by the existing premises on the north side of the river. Under the terms of the agreement the Middlesex site will be surrendered to the London County Council in exchange for the new site, and in addition the Council have agreed to pay to the railway company £325,000 in compensation for all loss, damage and accidents occasioned by the removal.

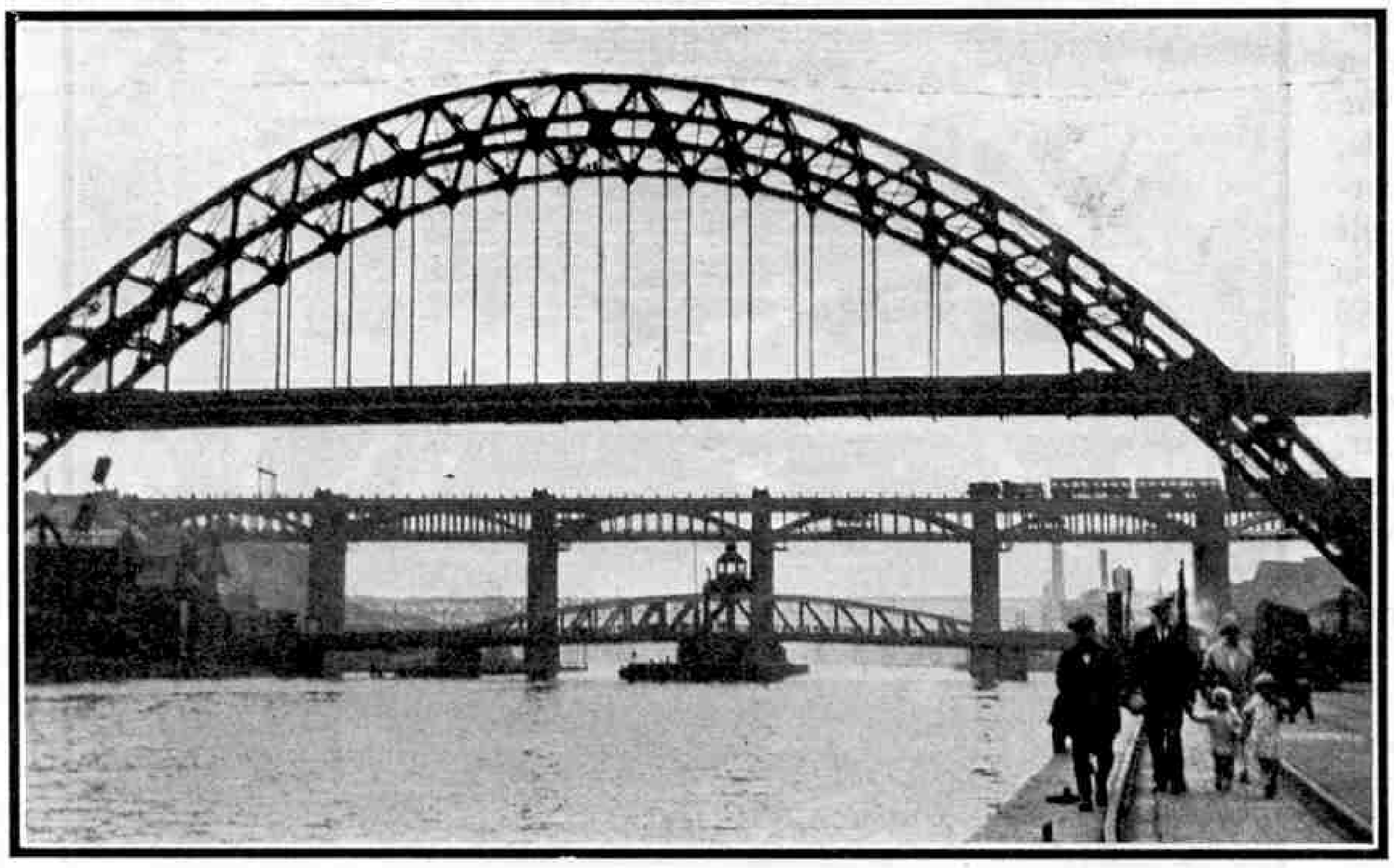
The total cost of the scheme, including the reconstruction of Waterloo bridge that has been in abeyance pending the agreement just made, is stated to be £13,446,000. The project has the approval of the Ministry of Transport, and immediately Parliamentary sanction has been obtained by the L.C.C. the work will be put in hand. It is anticipated that both the new railway station and the new road bridge will be completed in six years.

Manchester's Water Supply

The Manchester Corporation have decided to start work on the construction of a dam across the Mardale Valley in connection with their scheme to utilise Hawes Water in Westmorland to augment their existing supply of water. It is expected that the work involved in the scheme will occupy four years, and to accommodate the workpeople a special village with a church, cinema and school has been built.

Salving a Sunken Bridge Span

An interesting engineering feat that was completed recently in America was the salvaging and replacing of the 322 ft. lift span of the Newark Bay Bridge that was displaced during a severe storm last winter. When the span was brought to the surface it was found that although the steelwork had suffered very little damage it was completely covered with barnacles, and the removal of these proved a very difficult matter. The method of hand-scraping the various members that was at first employed had to be abandoned in favour of long-handled scrubbing brushes used in conjunction with caustic soda.



This photograph, which is the work of one of our readers, F. D. G. Bradshaw, is of unusual interest, as it shows one behind the other the four bridges that span the River Tyne at Newcastle.

The bridge in the foreground is the new one, which was approaching completion at the time the photograph was taken. The second bridge is the well-known Swing Bridge ; the third is the High Level Bridge carrying both a roadway and a railway, while just visible behind this is the King Edward VII Bridge

Special Ship for Transport of Paper

A specially designed steamship that will be used solely for the carriage of paper to ports along the Atlantic seaboard of Canada and the United States has been ordered by the Liverpool (Nova Scotia) Mill of the Mersey Paper Co. Ltd.

The vessel, which is to be built at Hull (England), will be specially constructed with the deck brackets above the main deck, so that the hold space will be entirely free from obstruction. The ship will have a capacity of 4,300 tons of paper, which will be loaded by derricks through hatches of extra large size into five watertight compartments. The total cost of the vessel will be approximately £112,500.

A Lift for Westminster Cathedral

What is probably the first electric lift to be used in any British church or cathedral has been installed in Westminster Cathedral, London. The lift is for the use of visitors who wish to ascend the tower, from which an exceedingly interesting view of London is obtained.

The distance from the ground floor to the top of the lift shaft is 180 ft., and this is covered in approximately 30 seconds. The normal load the lift is capable of lifting is 15 cwt., while the speed is stated to be 350 ft. per second.

The controls inside the car are very similar to those used in the majority of lifts except for the inclusion of two buttons, which, when pressed in the event of an accident, either bring the car to rest or slow down very considerably the speed of ascent or descent. Mechanical locking gates are provided on both floors of the lift, and when the landing gates and the gates on the car itself are shut, a green bulb inside the car and in view of the attendant is automatically lighted. A red light indicates that one of the gates is open or that there is something mechanically wrong with the working of the lift. It is interesting to note that a telephone is included in the car, so that the attendant can speak direct either to the engineer in charge of the engine room, or the porter, whose lodge is at the entrance to the Cathedral.

Proposed Road Bridge across the Forth

A proposal at present engaging the attention of the Ministry of Transport is that of constructing a road bridge over the Firth of Forth. A preliminary report that has recently been completed suggests three possible sites for such a bridge. The most favourable one appears to be located at a point about a mile downstream from the Forth Bridge, and it is suggested that a road bridge of the suspension type, having a main span 2,400 ft. in length and side spans 1,040 ft. in length should be built at this point.

Cranes at Preston Dock

The photograph on this page, which is reproduced by the courtesy of Vickers Armstrong Ltd., shows cranes supplied to the Ribble Navigation at their Preston Dock. The cranes are of the Mitchell-Williams level luffing type and the load with which these have to deal is 30 cwt., the maximum radius being 65 ft. and the minimum 20 ft. The load is lifted to a height of 70 ft. above and can be lowered to 40 ft. below coping level. The cranes have a slewing range of $1\frac{1}{4}$ turns, the gauge on which they work being 13 ft. 6 in.

The lifting machinery is secured between the side plates of the pillar and consists of a hydraulic cylinder fitted with plunger, crosshead guides, multiplying gear (multiplying 8 to 1), and a $\frac{5}{8}$ in. diameter chain fitted with a lifting hook of an approved pattern. This chain passes over a sheave at the lower end of the jib and the roller carriage, the proportions of the supporting links and the positions of the fulcrum on the jib being such that the load travels in a horizontal path while luffing.

The luffing machinery consists of two direct acting hydraulic cylinders acting directly on the top and bottom of the jib roller carriage for luffing in and luffing out respectively.

More Subways for London

The London County Council have decided to grant applications to join buildings to Tube railway stations by means of subways, on condition that satisfactory precautions are taken to ensure the safety of the public. The object of this decision is to diminish as much as possible the pedestrian traffic that throngs the streets of London day by day. The first application for the construction of such a subway was made by the proprietors of the Dominion Theatre, who proposed that the theatre should be placed in direct communication with the Tube station at Tottenham Court Road.

It is to be hoped that this idea will prove popular, and that such subways will become extensively used by theatres, large stores, etc. There is no doubt that the streets of London are seriously overcrowded, and if there were no need for pedestrians to cross streets in order to reach a station, after leaving a place of entertainment or a large shop, traffic would be considerably speeded up. Another important point is that accidents to pedestrians at street crossings would be greatly reduced.

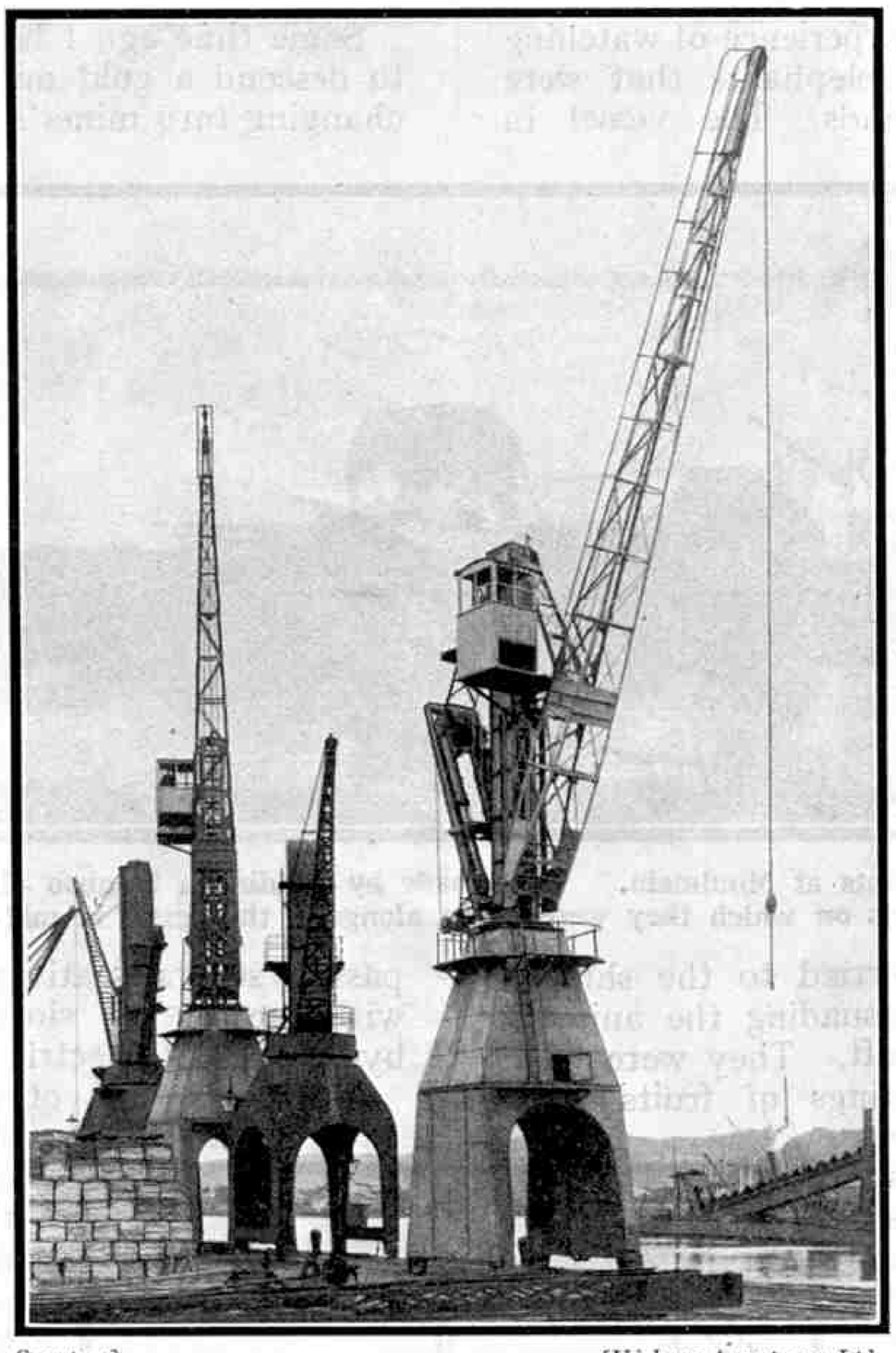
A Rivetless Steel Building

A large steel building recently completed at Niagara Falls has been constructed entirely without rivets, the whole of the jointing being carried out by means of gas welding. The building is 260 ft. in length, 75 ft. in width, and over 42 ft. in height, and 297 tons of steel were used in its construction. It is stated to be the first large structure in which gas welding has been used exclusively, and building experts believe that in the very near future large cities will be free from the noise of the riveter's pneumatic hammer, and that skyscraper construction will proceed in comparative silence to the nerve-racking din made at present.

The World's Largest Lock

Work is now approaching completion on the new lock at Ymuiden, a town at the seaward end of the ship canal that links Amsterdam with the North Sea. This lock is the largest in the world, and there is no vessel afloat that is not capable of passing through it. Its dimensions are 1,312 ft. in length and 164 ft. in width; while the water is 50 ft. in depth over the sill. By way of comparison it may be stated that the Panama Canal locks are 1,000 ft. in length, 110 ft. in width and 42 ft. in depth over the sills.

Some idea of the size of the Ymuiden lock may be obtained from the fact that its construction involved the excavation of 26 million cubic yards of earth and rock. The walls and sills contain 8 million ft. of concrete, and 19,000 tons of steel bars were used for reinforcing the concrete. The lock has been under construction for 10 years, and has cost about £1,500,000.



Courtesy [*Vickers Armstrong Ltd.*

A group of level luffing cranes at the Preston Dock of the Ribble Navigation

Cross-Channel Motor Boat Records

Motor boat records for the journey from Dover to Calais and back are being made and broken very rapidly. First of all the Hon. Mrs. Victor Bruce accomplished the return journey in 1 hr. 47 min. Not long afterwards Mr. Kaye Don, the famous racing motorist, accomplished the trip in 1 hr. 23 min., in his 200 h.p. boat, carrying two passengers and an engineer.

Subsequently the Hon. Mrs. Bruce, also using a 200 h.p. motor boat, attacked this record and succeeded in covering the distance in 1 hr. 19 min. $24\frac{1}{2}$ sec.

New White Star Liner Launched

A new 27,000-ton motor ship, the "*Britannic*," which has been constructed for the White Star Line by Harland and Wolff, has been launched from their Belfast yards. As stated in the April issue of the "*M.M.*", this is the third White Star vessel to be given the name "*Britannic*." The first one, which displaced 5,000 tons and was built in 1873, set up a new trans-Atlantic record between Liverpool and New York of 7 days, 12 hours, 47 minutes. Altogether this vessel covered approximately 2,000,000 statute miles in 270 trips between Liverpool and New York.

The launch of the second "*Britannic*" took place towards the end of February, 1914. This vessel had a very brief career, for she was mined and sunk two years later in the Ægean Sea, while acting as a hospital ship.

The new liner is not only the first motor vessel in the White Star fleet, but is also the largest motor ship yet constructed in Great Britain. She is 680 ft. in length, 82 ft. in breadth, and 43 ft. 9 in. in depth. She is fitted with a double bottom in which water and oil supplies are carried, and the hull is divided into 13 water-tight compartments. Every convenience for passengers is provided, including a swimming pool, tennis court, and an extensive totally enclosed promenade.

Four Diesel-driven electric generators possessing a total capacity of 2,000 k.w. are installed in the vessel, while in the event of a breakdown in any of these an auxiliary generator of 75 k.w. capacity can be brought into service. The generators are required to supply electricity for the great amount of electrical apparatus used in the ship. All the food is cooked by electricity and electric elevators are installed in the tourist and third-class quarters. The electricity generated is also used to drive 75 fans, many of which are adapted so that during cold weather the air will be warmed by them. Other heating is also by electricity.

We hope shortly to give a full description of this vessel, together with photographs.

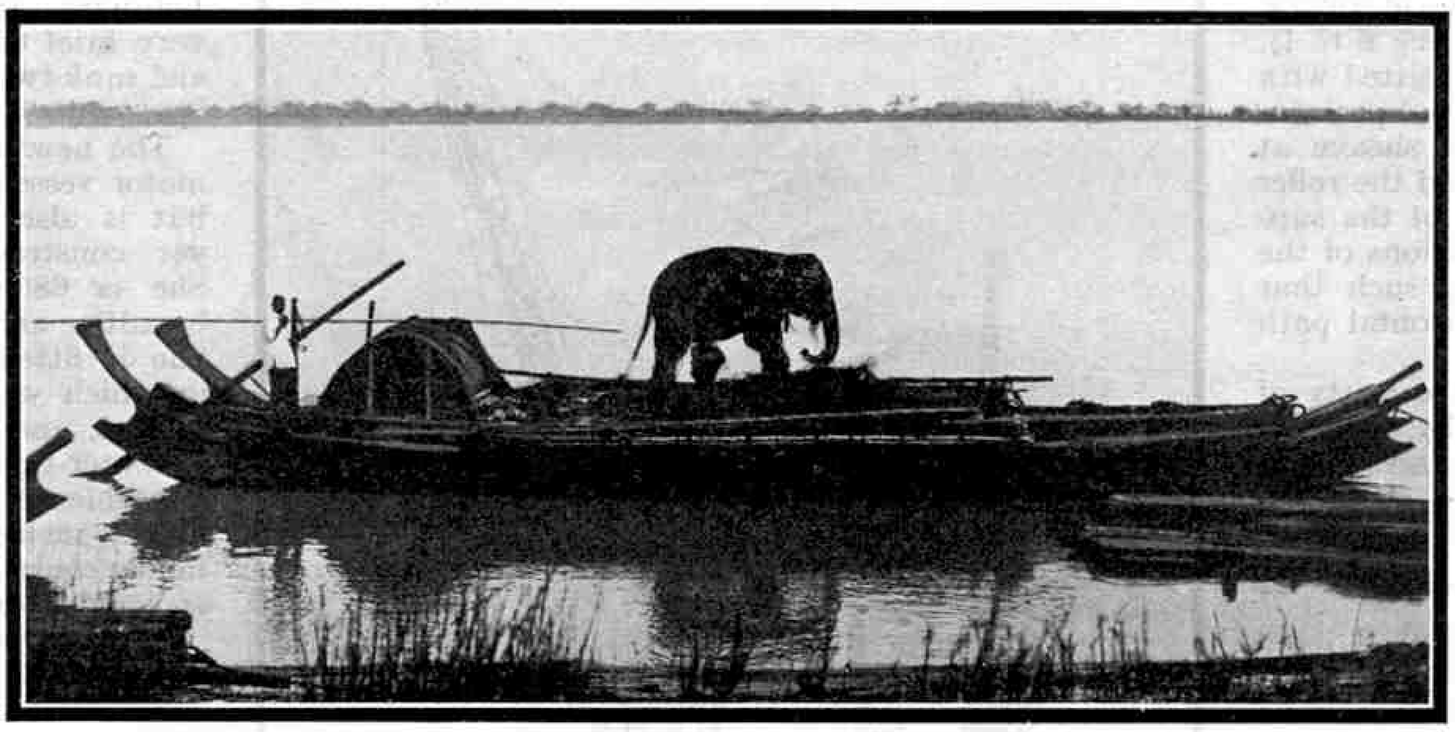
The Institute of Marine Engineers

The Council of the Institute of Marine Engineers desire to remind young engineers and apprentices that the Institute's annual examination for Student Graduateship and the accompanying diploma, which is both open to graduates and others not yet associated with the Institute, will be held from the 7th–10th April, 1930, at centres arranged to suit candidates. The superintendent engineers of the leading shipping companies recognise that possession of this diploma is proof of all-round ability in the technical subjects specially required as the foundation of a successful career.

Of particular appeal to ambitious and studious apprentices is the annual offer of the Lloyd's Register Scholarship, value £100 per annum and tenable for three years at an approved university. The next examination for the scholarship will be held on 12th–13th May, 1930, at various centres. Full particulars may be obtained from the Secretary, Institute of Marine Engineers, London, E.C.3.

Loading Elephants in Burma

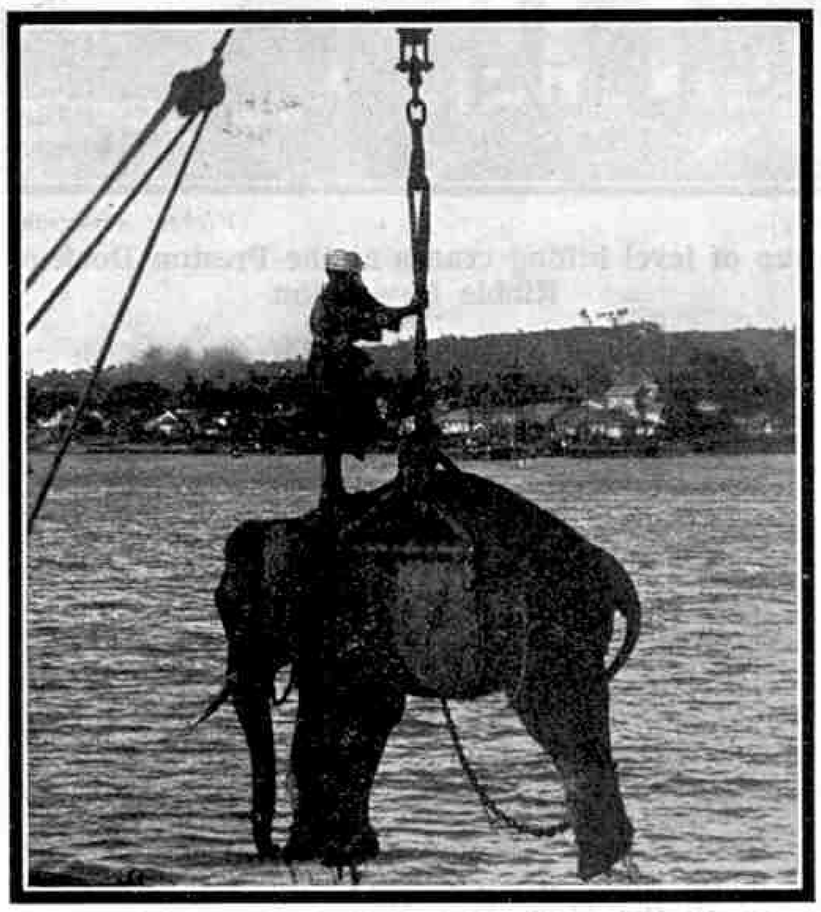
Recently I had the interesting experience of watching the embarkation of 14 Burmese elephants that were destined for the Andaman Islands. The vessel in which they were to make the voyage lay in mid-stream, for there is no suitable wharf at Moulmein, the port at which they were to be loaded. After consultation it was decided to take the elephants to the side of the ship on a raft built by laying a platform of bamboo rods across two country boats. This was large enough to enable one elephant at a time to be ferried to the ship.



Loading elephants at Moulmein. Raft made by building a bamboo platform across two boats on which they were taken alongside the vessel in mid-stream

Trouble was experienced in persuading the animals to trust themselves to the frail raft. They were very stubborn, and even liberal offerings of fruits they enjoy could not induce them to leave solid land. The Burmans then thought of making offerings to the "gâts," or Burmese spirits. Strange to say this was effective, for the elephants immediately became docile, and each of them unhesitatingly stepped aboard the raft when its turn arrived.

When an elephant had been led on board, the raft was towed alongside the ship and a wide belt was passed underneath the animal's body in order that it might be hoisted on deck. As might be expected, the elephants became very restless under this novel treatment, and their embarkation was the work of hours, the mahouts having to stand on the backs of their charges in order to reassure them. I certainly did not envy these men, for it did not appear to me to be either safe or pleasant to be hoisted into mid air on the back of a restive and suspicious elephant! The men appeared to enjoy the novel situation, however, and the tedious task was accomplished without mishap. At the end of a day's hard work the elephants departed on their short voyage to the Andaman Islands. L. SECLUNA (Moulmein).



An uncomfortable aerial trip for an elephant and his mahout!

Down a Gold Mine on the Rand

Some time ago I had the good fortune to be allowed to descend a gold mine on the Witwatersrand. After changing into miner's kit I took my place in the cage, which in one minute carried me to the workings 2,000 ft. below the surface. When the cage came to rest at the bottom of the shaft I stepped out to find myself in a large gallery containing a workshop and a pumping station. I passed through this and commenced to descend steep inclines that led toward the workings. As I went along I passed several natives at work hauling trams laden with ore up the slopes, and lowering empty wagons by means of electric or compressed air winches.

At the bottom of the slope was another pumping station, outside which stood an electric locomotive. Following the example of my guide I mounted the footplate, and the locomotive was then started on the journey to the place where the ore is mined. The trip on this queer underground railway was very interesting. Its length is about two miles, and the gauge of the track is 18 in. The locomotive has two 40 h.p. motors, and I was told that it is capable of hauling 16 trams full of ore. Although on the level its speed is about 12 miles per hour, we moved at only half this speed, for there were many steep inclines on the way.

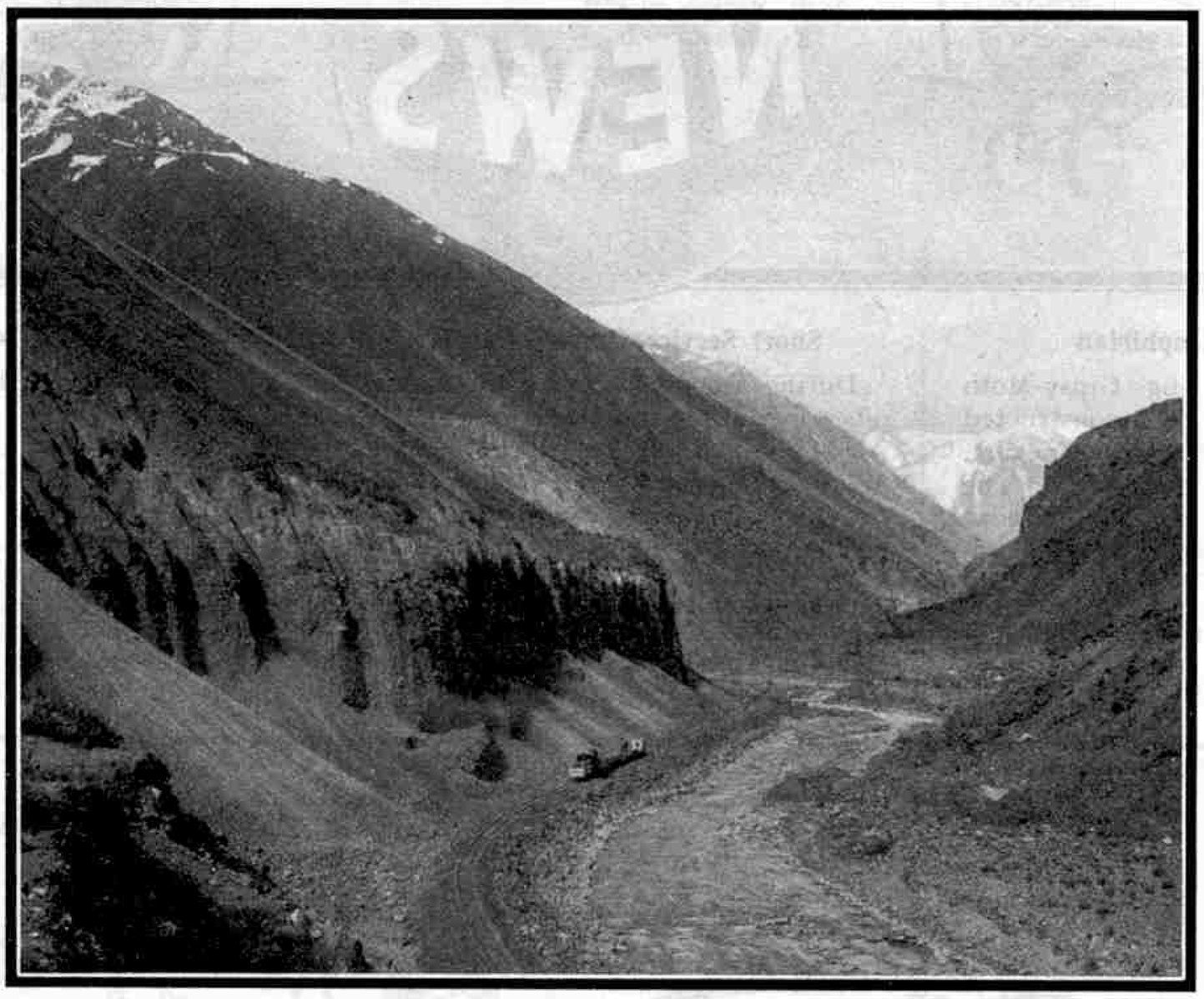
On arrival at the point on the line nearest the working face, I walked up a "stope," in which natives were engaged drilling holes in the gold-bearing rock with pneumatic jackhammers. Into these would be inserted the charges of explosive that would break up the rock.

After an inspection of all the operations I returned to the foot of the shaft in a "Scotch cart," which is a tram used for hauling workmen up inclines on their way to and from the working face. W. MORGAN (Transvaal).

Across the Andes by Rail

After living in Chile for eight years, my parents decided to return to Europe. The first stage of the long journey was made by the trans-continental railway that runs from Valparaiso to Buenos Aires, and crosses the Andes by the Uspulato Pass, which rises to a height of almost 12,600 ft.

Our first stop after leaving Valparaiso was at Los Andes, where we spent the night. At a very early hour on the following morning a train was waiting in the garden of the hotel for those passengers who wished to proceed further. A garden seems a curious place in which to find a train, but the arrangement is very convenient for travellers from the west who have spent the night in the hotel.

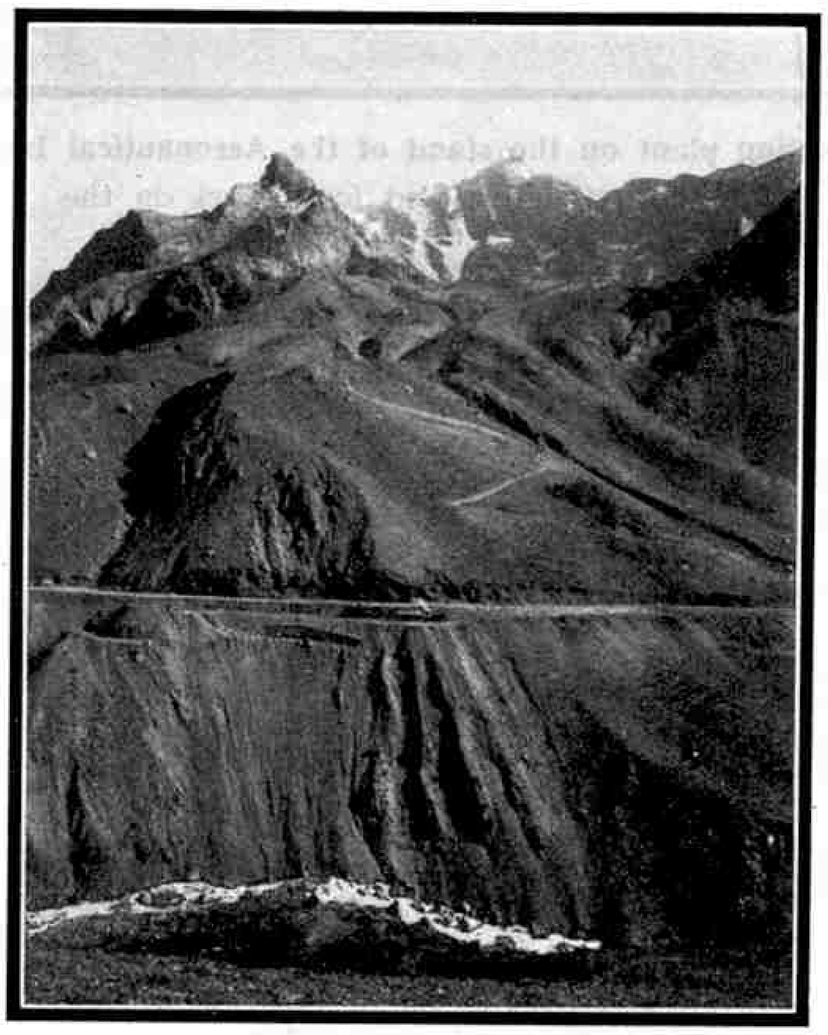


A wild mountain pass in the Andes through which runs the trans-continental railway from Valparaiso to Buenos Aires

As far as Los Andes the journey had not been very interesting, but on leaving that station we passed through some of the most wonderful scenery. The line passes near Aconcagua, the third highest mountain in the world, which rises to the enormous height of 23,352 ft. ; and it penetrates valleys that are surrounded by innumerable snow-covered peaks almost as lofty as Aconcagua itself.

A very interesting spot that is visible from the train is the famous Salto del Saldado, or Soldier's Leap. This is a huge gap between two rocks on the ridge of a mountain. It is said that during one of the wars of last century a soldier jumped across the chasm in order to escape from pursuing enemies.

Shortly after passing the Soldier's Leap we encountered a heavy snowstorm and the train was brought to a standstill. All efforts to clear the track by means of a snow-plough failed, and in the end we were compelled to continue our journey in a slower and more humble manner on donkeys brought from a neighbouring farm. On these animals we set off for the next station beyond the obstructing snow-drifts, trying in vain to find a comfortable place on their long bony backs, for the farmers from whom they had been obtained could not supply saddles.



The railway across the Andes runs near Aconcagua, 23,352 ft. in height, the third highest mountain in the world

The station at which our uncomfortable donkey ride came to an end is called Puente del Inca, and is the border station between Chile and the Argentine. Shortly after our arrival a relief train left for Mendoza, a town noted for its wonderful vineyards, in which we enjoyed a very pleasant stay of about three hours.

Continuing our journey eastward, we travelled through the night and in the morning were surprised to find ourselves covered with a fine black dust that arises from the well-known Pampas of the Argentine. The rest of the journey was comparatively tedious, the monotony being relieved only by the sight of a few ostrich farms and some small towns through which we passed, and we were very pleased to reach Buenos Aires. At this port awaited the vessel on which we were to complete our long journey to Europe.

R. A. HERRMAN (Berlin).

England's Highest Spire

Climbing to the spire of Salisbury Cathedral proved to be a very interesting if strenuous task. The first flight of steps was circular and ended in a large hall that in appearance resembled a grotto. The floor of the hall appeared to be deeply pitted, this being due to the fan tracery on the ceiling below.

Crossing the hall by means of a wooden bridge I entered another room containing the works of the Cathedral clock, and from it ascended a second long flight of steps, passing the bell room on the way up. Just before reaching the top of the staircase, I was surprised to find the nest of a peregrine falcon. I climbed over this with some difficulty and passed through a door that opened out on to a balcony, from which I obtained a magnificent view over a wide stretch of country surrounding the Cathedral.

D. E. GASCOYNE (Salisbury).

The First Moth Amphibian

An extremely interesting Gipsy-Moth amphibian machine has been constructed to a special order by Mr. Scott-Taggart, the well-known radio engineer. The actual machine and the single main float are both of standard construction, the latter being made of duralumin by Short Bros., of Rochester, who were responsible for the construction of the whole of the under-carriage. When this machine is intended for land use the two landing wheels are extended on spring legs below the float.

At the rear of the machine is a specially-designed contrivance that can be made into a water rudder or a skid similar to that used on a normal land machine. The skid and the landing wheels have been constructed so that it is possible for the pilot to convert the machine from a landplane to a seaplane while he is actually in the cockpit. Small floats are fitted on the end of each of the lower wings to prevent them from going under water if the machine is heeled round when taxi-ing. This amphibian Moth aroused great interest at the recent Aero Show at Olympia.

New Canadian Air Mail Services

Two new air mail services were inaugurated recently at Toronto, Canada. The services operate daily. One is between Toronto and Detroit, U.S.A., while the other connects with Buffalo, N.Y. The Toronto-Detroit service is operated by Canadian Airways Ltd., and the 550-mile trip is covered in less than seven hours. This service provides a through air mail connection from Montreal to Detroit with extensions to Chicago and the Pacific Coast. A Toronto-Buffalo service is operated by Canadian Colonial Airways Ltd., with amphibian machines.

One of the most important features of the new extended air mail service is the speed at which overseas mails are conveyed across the continent. Mails taken ashore from ocean liners at Rimouski, on the lower St. Lawrence, are carried by the new air route to Chicago where they arrive sooner than if transferred to aeroplanes at New York.

Short Service Officers for R.A.F.

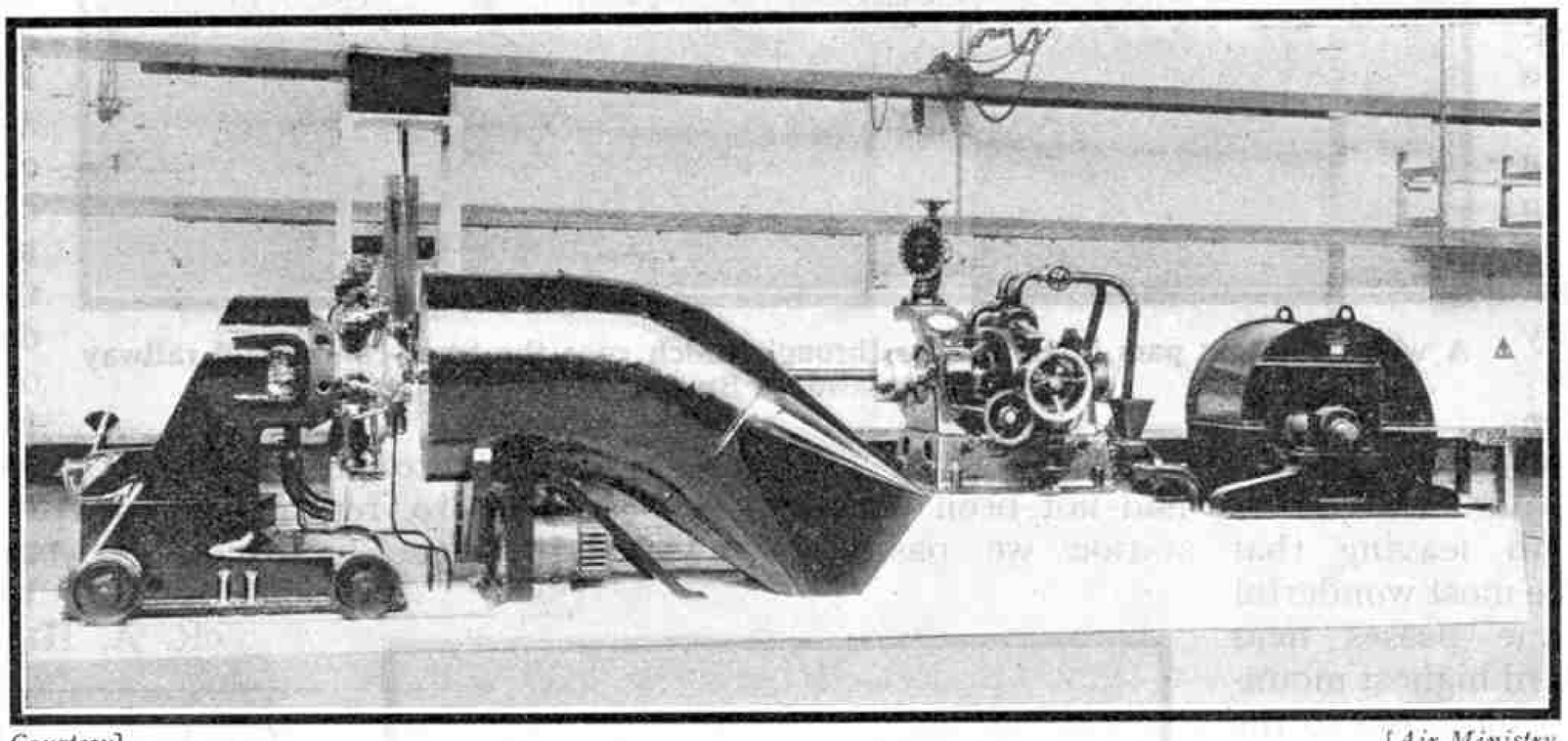
During the next few months about 100 officers will be required by the Royal Air Force for flying duties under the short service commissions scheme. Applications are invited from well-educated candidates of good physique who are between the ages of 18 and 25. Selected candidates will appear before the Interview and Medical Board at the Air Ministry, London, and if accepted will be granted short service commissions for five years on the active list and four years on the reserve.

During their period of service officers have facilities for preparing themselves for civil life, and assistance in obtaining employment is given to them when they pass to the reserve. In addition a competitive examination is held annually, as the result of which certain short service officers are appointed to specialist courses in engineering, wireless telegraphy, etc., with a view to obtaining permanent commissions in the R.A.F.

Accepted candidates enter as pilot officers on probation with pay of about £273 a year, increasing on promotion to flying officer to about £343. Officers receive also free quarters, rations, fuel and light, etc., or, where these are not available, cash allowances amounting at present to about £141 a year. On joining for duty officers with no previous service receive an outfit allowance of £50. A gratuity of £375 is payable on termination of five years' service on the active list.

This is an attractive scheme and one that provides excellent opportunities.

Application forms and full particulars will be sent to anyone interested on applying to The Secretary, Air Ministry, Kingsway, London, W.C.2.



Courtesy] [*Air Ministry*

The aero engine testing plant on the stand of the Aeronautical Inspection Directorate

Instruments to be Carried by Aircraft

According to the air navigation directions issued by the Secretary for Air, it is necessary for a flying machine of any nature to be fitted with an air speed indicator, an altimeter, a revolution indicator, and such gauges as are considered necessary by the Secretary for the particular installation. A flying machine is required to carry also a safety belt for each person, including the pilot, carried in an open cockpit. For night flights machines are required to carry indication lights and also illumination for instruments and equipment.

If a flying machine is to carry "passengers or goods for hire or reward," for all flights extending beyond a radius of 20 miles beyond the point of departure, it must carry a compass, a watch, and if the number of seats in the machine exceeds five, a turn indicator. It must carry also a map or maps to cover the whole route of the proposed flight.

If a licensed navigator other than a pilot is included in the personnel of the machine, a drift indicator must be included; while if the pilot's instruments are not readily visible to the navigator a second air speed indicator, a second altimeter and a second compass are required.

Invention to make Landing Safer

One of the dangers that confront the novice when attempting to land an aeroplane is that the machine may reach the ground at an angle that is too steep, which causes the machine to nose over, often with disastrous consequences. A French inventor has suggested a means for preventing accidents of this kind. His idea is that auxiliary wheels should be mounted in front of the main pair, and to these he proposes to attach levers pivoted on the axle of the landing wheels, and having their rear ends connected with the fuselage of the plane by elastic ropes.

In an awkward landing with a machine fitted with this device the auxiliary wheels will strike the ground first, and as they are forced upwards the levers will tend to pull the fuselage downwards, and thus restore the machine to a level keel.

The Inspection and Testing of Aero Engines

One of the most instructive exhibits at the International Aero Exhibition at Olympia, London, was that of the Aeronautical Inspection Directorate of the British Air Ministry, which featured the whole system of inspection from the raw material up to the finished aeroplane and its engine.

A particularly interesting feature on this stand was the full-sized brake testing apparatus used for trying out 215-230 h.p. Armstrong-Siddeley "Lynx" engines. At one end of the stand is a powerful fan that creates a current of air and drives it under a dynamometer and through a tunnel on to the forward face of the engine. The brake testing apparatus is fitted between the engine and the fan, and is driven by a shaft coupled up to the engine and passing through the cowling of the tunnel. The engine is mounted on a trolley in order to enable it to be wheeled up to the mouth of the air tunnel and withdrawn at the conclusion of the test with the least possible delay.

A novel photographic effect was shown on the same stand. Behind the testing apparatus were what purported to be the windows of the Armstrong-Siddeley factory, through which were shown, by means of large and illuminated coloured photographs, the machine and heat treatment shops and other departments.

Guild for Air Pilots

At a meeting held a short time ago an organisation to be known as the Guild of Air Pilots and Navigators of the British Empire was formed, and Air Vice-Marshal Sir Sefton Brancker, K.B.E., A.F.C., Director of Civil Aviation was appointed Master. The main work of the Guild is, in the words of the "*Aeroplane*," "to uphold the status and prestige of air pilots who are qualified as air navigators, and air navigators who may not happen to be pilots."

Candidates for membership of the Guild are required to be of British nationality and to have held a class "B" license for at least five years. They are also required to be in possession of a first-class airship pilot's license, or else a certificate of competency as a first class navigator of commercial aircraft.

A New Definition of "Airmen"

A native soldier at Ankpa, West Africa, says the "*Aeroplane*," when asked for a definition of "airmen," referred to them as "them God palaver beef who live for up"!

Climbing Powers of Cars and Aircraft

The tremendous climbing powers of the modern fighting aircraft are illustrated by the following comparisons.

On one particular hill the record stands at 45 m.p.h., representing a vertical speed of a little over 3 m.p.h.; whereas the vertical speed of the latest Armstrong Siddeley fighting aircraft varies between 14 and 20 m.p.h. The average gradient on the hill is 1 in 8, but the average gradient climbed by aircraft is 1 in 6.

To India and Back in Seven Days

One of the greatest feats yet performed in the air was brought to a successful conclusion by the arrival in this country from India of Capt. C. D. Barnard and the Duchess of Bedford. The time taken on the journey of 4,400 miles from Karachi was only 3 days 12 hours. The outward flight occupied 3 days 9 hours, and the interval between leaving Lympne Aerodrome on Friday, 2nd August, and reaching this country after the double flight, was only 7½ days, of which less than seven were actually occupied in flying. The machine used was a Fokker F VII monoplane with a Bristol "Jupiter" geared engine.

It is interesting to compare the time taken on this flight with that allowed for the Air Mail service. By train, seaplane and aeroplane, letters reach Karachi in seven days, a period that sufficed Capt. Barnard for the double journey, in spite of the fact that several stops were made.

On the first day of the outward journey the aviators covered 1,400 miles in 11½ hours, landing at Sofia at 4.15 p.m. The succeeding daily "hops" took the machine to Aleppo, Bushire, and Karachi respectively, the Indian city being reached at 11.30 p.m. on Monday, 5th August, after a long flight through a dense haze. The return flight was commenced early next morning, when poor visibility made it impossible to fly at more than 200 ft.

Courtesy] [*Rolls-Royce Ltd.*

H.R.H. the Duke of York shows great interest in an 830 h.p. Rolls-Royce aero engine at the Aero exhibition

Apprentice Clerks for R.A.F.

The Air Ministry announce that 60 vacancies exist in the Royal Air Force for well-educated boys, between the ages of 15½ and 17, to enter as apprentice clerks. Thirty vacancies will be filled next month and 30 in January, 1930. Some of the posts will be filled by means of an open competition that will be held by the Civil Service Commissioners next month at various centres (for entry in January, 1930), and the remainder by direct entry of boys who have obtained an approved school certificate. Successful candidates will be required to complete, in addition to the training period, 12 years' Regular Air Force service after reaching the age of 18. At the age of 30 they may return to civil life or may be permitted to re-engage in order to complete time for pension.

Boys entered under this scheme undergo a two years' course of training in clerical duties, typewriting, shorthand, bookkeeping and practical office routine, during which time their general education is continued under a staff of graduate teachers.

The apprentice clerks are paid 1/– a day for the first year and 1/6 a day afterwards. The subsequent commencing rates of pay, varying from 3/– to 4/6 a day (21/– to 31/6 a week), depend upon the degree of success they achieve at their final examination. In addition, they receive free board and lodging.

Detailed information regarding the apprentice clerk scheme can be obtained from the Royal Air Force, Gwydyr House, Whitehall, S.W.1.

Imperial Airways Air Fleet

In our May issue we published a complete list of aircraft owned by Imperial Airways Ltd. Since then the company have acquired three new Armstrong Whitworth "Argosy" machines, numbered G-AACH, G-AACI, and G-AACJ, which are now in use on their Silver Wing service to Paris. A new flying boat numbered G-AADN has also been put into service, while G-EBMT unfortunately had to be landed alongside a vessel in the Channel.

The names of the aircraft now owned by Imperial Airways are as follows:—

EUROPEAN DIVISION—
G-EBLO, "*City of Birmingham*";
G-EBLF, "*City of Glasgow*";
G-EBOZ, "*City of Wellington*";
G-AACH, I & J, not yet named;
G-EBMM, "*City of Melbourne*";
G-EBMR, "*City of Pretoria*";
G-EBBH, "*Prince George*";
G-EBBI, "*Prince Henry*"; G-EBIX, "*City of Washington*"; G-EBFP, Unnamed.

MEDITERRANEAN DIVISION—
G-AADN, Not yet named (Flying Boat);
G-EBVH, Not yet named (Flying Boat);
G-EBVG, "*City of Alexandria*" (Flying Boat); G-EBGR, Unnamed (Flying Boat).

NEAR EAST DIVISION—G-EBMW, "*City of Cairo*"; G-EBMX, "*City of Delhi*"; G-EBMY, "*City of Baghdad*"; G-EBMZ, "*City of Jerusalem*"; G-EBNA, "*City of Teheran.*"

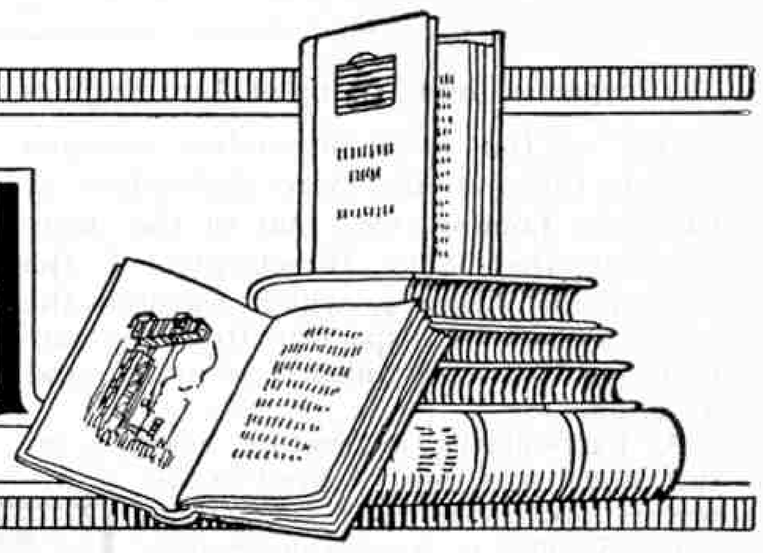
Further names and identification letters will be published from time to time.

THIS MONTH'S AIR STORY

Short aeroplane flights at five shillings a time were being given in a suburb of a small town. After a good deal of hesitation a fussy old gentleman decided to risk a flight, but before embarking he asked the pilot to be sure to bring him back safely.

"That I will, sir," said the pilot. "I've never left anybody up there yet!"

Books to Read



On these pages we review books that are both of interest and of use to readers of the "M.M." We have made arrangements to supply copies of any of these books where readers find difficulty in obtaining them through the usual channels.

Orders should be addressed to the Book Dept., Meccano Limited, Old Swan, Liverpool, and 1/- should be added to the published price of the book to cover the cost of postage. The balance remaining will be refunded when the book is sent, as postages on different books vary according to the weight and destination.

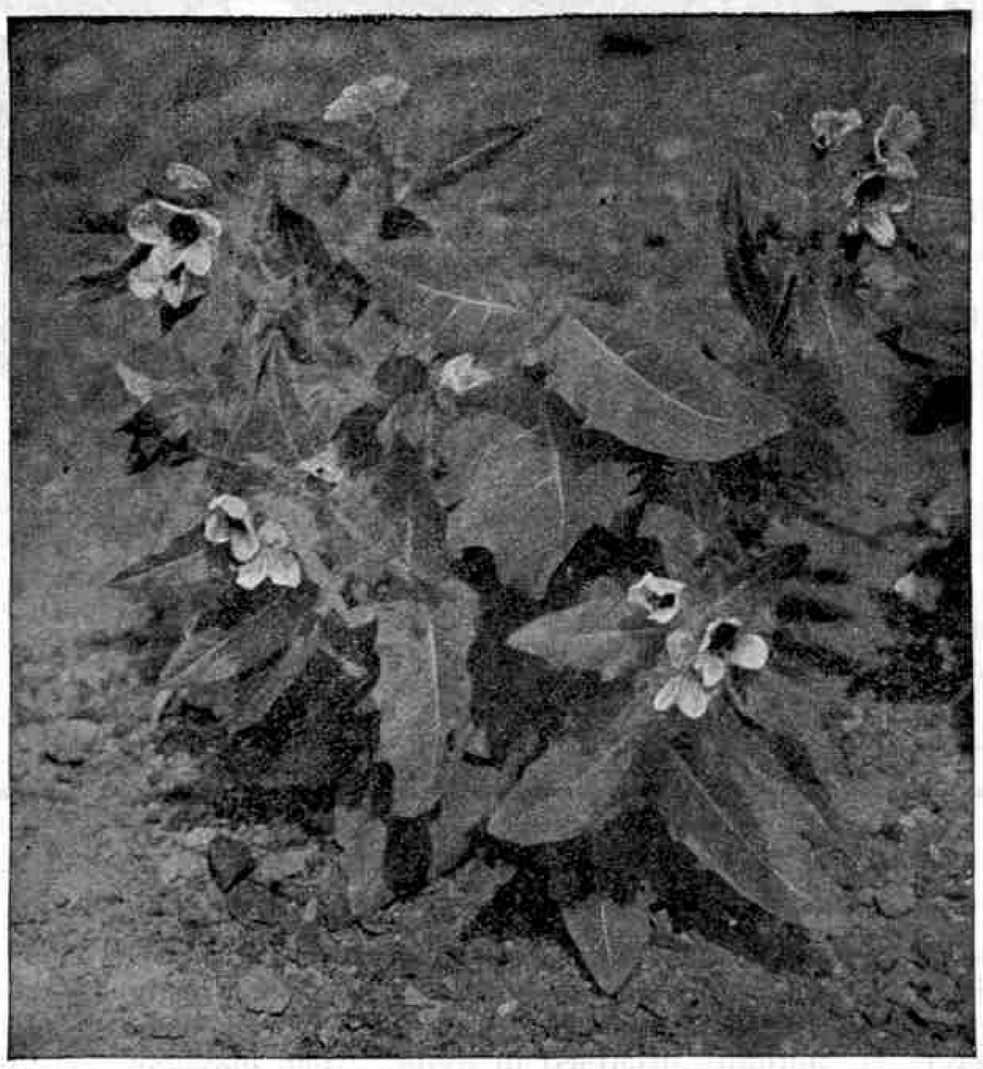
"Wayside and Woodland Blossoms"

By Edward Step, F.L.S.
(Fredk. Warne & Co. Ltd. 7/6)

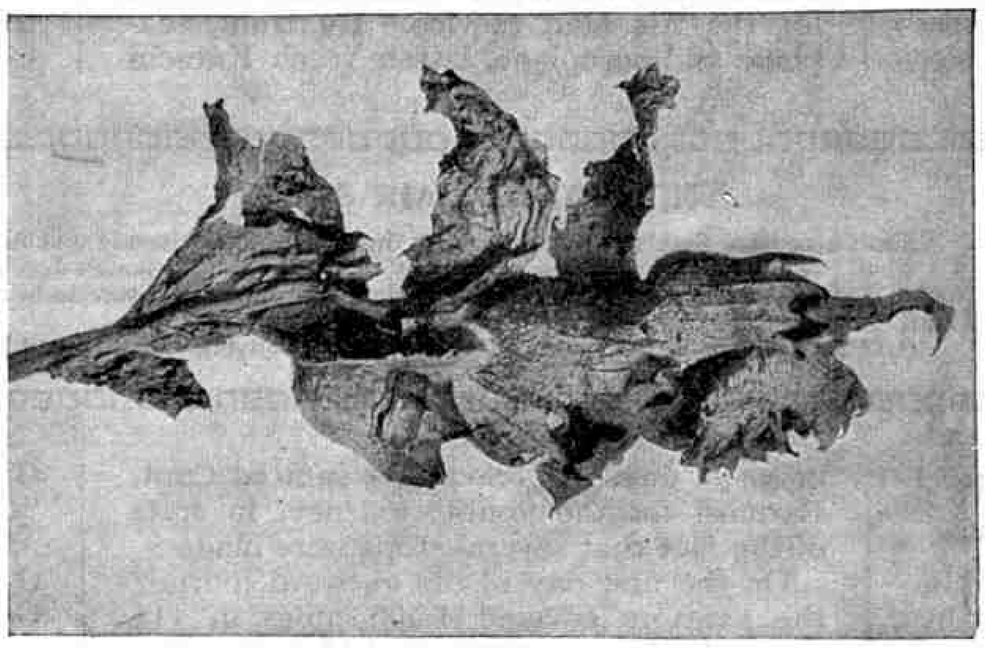
This book—one of the "Wayside and Woodland" volumes, a series of publications that are well-known to all Nature lovers—consists of 176 pages. The illustrations include numerous halftones and 64 coloured figures, as well as diagrams in the text. It is handy in size, and as a pocket guide to British wild flowers it will be of great service to all interested in the countryside.

The book is divided into five parts dealing with the Forms of Leaves; Descriptions of Wild Flowers; What are Orchids; British Orchids; and Family Characters of British Plants. In addition, there is a classified index to the natural orders, genera and species described in the volume and also a general index.

Mr. Edward Step requires no introduction to Nature students for his books on Trees, Ferns, Shell-life and other kindred subjects are well-known. To the country rambler the book will be of inestimable value, more particularly during the summer months, while for the remainder of the year it will be equally valuable as a book of reference.



(Above) Henbane (*Hyoscyamus niger*). (Below) Henbane Fruits. Two illustrations from "Wayside and Woodland Blossoms," reviewed on this page



"How to Choose Your Career"

By W. Leslie Ivey
(Sir I. Pitman & Sons Ltd. 3/6 net)

Many books have been written with the object of pointing out the necessary steps that have to be taken to enter various professions, but almost all these have been deficient in the very essential matter of giving advice as to the career to be chosen. In "*How to Choose a Career*" Mr. Ivey tackles this problem at the outset and gives some very sound advice.

There is a tendency among parents to suppose that every small boy who chalks upon a fence should become an artist, and that every youngster who shows skill in handling a model yacht is destined to become the commander of an Atlantic liner! Early activities of this kind have a certain amount of value, but unless they are carefully considered in conjunction with other matters they are apt to be entirely misleading. If every boy approaching the end of his school days possessed an unmistakable inclination for a certain type in which his life work should lie.

Mr. Ivey emphasises the fact that the reason for choosing a particular occupation for a boy is his own individual suitability for it, and not any attractiveness that it may present. The choice of an occupation simply because it is attractive is almost always fatal. It is necessary for a boy who means to succeed to examine himself seriously in regard to his abilities, and to select finally a career for which he feels that he has real ability, and in which he is determined to succeed by dint of sheer hard work.

The subsequent portions of Mr. Ivey's book deal with the best methods of entering various careers, and his advice seems to us to be thoroughly sound. He keeps in the forefront the whole time the necessity for concentration upon the particular work in hand, and in particular he emphasises the fact that success in any career can only follow the realisation that "second best" is worthless.

"Life in Rural England"

By W. Coles Finch
(C. W. Daniel Company. 10/6 net)

The history of a great nation has usually been written in terms of wars, kings and parliaments. Such records may chart the rise of empire but they do not picture the real life of the nation. The real history must surely be the story of a people. This book, "*Life in Rural England*," seems a true record of our land.

Rural England is in danger of falling before the steady invasion of the modern builder and the forces of modern transport. Hence the need that what was England's glory and still remains its charm, shall be preserved in faithful record and excellent picture. The author sketches the village life that centred around the church, was kindled on domestic hearths and throve in rustic hearts. The folk who were craftsmen indeed are pictured here in true form, the blacksmith and the wheelwright, the artisan and the husbandman, the miller and the sexton. Their families practised the 'valorous art of thrift.' To them poverty was very near but contentment was very real. Such men and the families are indeed the sinew as well as the soul of England. The home which is the vital spot of national life is here given full stretch. The wonder of inglenooks and the interest of the columbarium are made vivid through pen and lens. The author does not merely describe the architecture of the village home, but he deals also with the inner life and the inhabitants. The valentine—that anonymous token of a love-sick swain—brings back the days of grandparents in happiest vein; the old furniture and ornaments make the rural fireside a thing of unique beauty. Our love of Nature makes the record of the birdcatcher and the secrets of the poacher into adventurous yarns beloved by boys of all ages.

Lest History be forgotten, the stories of

the wind and water mills are made the means of telling how Walloons and Huguenots, Saracens and Crusaders each brought to this land of ours gifts and arts that have enriched us.

The England of the middle nineteenth century was virtually 'under sail' for mills were general. The 'fulling mills' of the wool trade, the tide mills that were ousted by river mills and beaten by windmills, are shown in all their glory. There are pictures of watermills in St. Christopher's day and a thrilling tale of a spy mill in war-ridden Europe. The old and new blend in perfect harmony. The problem of industrial life has an embryo here in the occupational disease 'the miller's throat.' The mill has much of interest and we find that the modern steam turbine is only a windmill whose blades are turned by steam! The mill has its place in literature. Daudet, Reade, Meredith, Austin and Blackmore have made it a theme in their fiction, while poets have sung of it and artists have made it the subject of great pictures.

In the author's description of the towns of rural England, Rochester is typical of our national life. The street cries, the ancient markets and local celebrities all contribute to this vivid picture of the England of yesterday. There is room for folklore in its pages. The story of how the sea became salt is fit to rank with most old time stories.

This in brief, shows the range of a book that is unique in its matter, accurate in its detail and fascinating in its style. The synopsis of the contents, which prefaces the book, and the illustrations that adorn it make altogether a volume that will interest young and old. It is a worthy addition to "*The History of the English People.*"

Rev. J. H. MARTIN.

"Athletics of To-day"

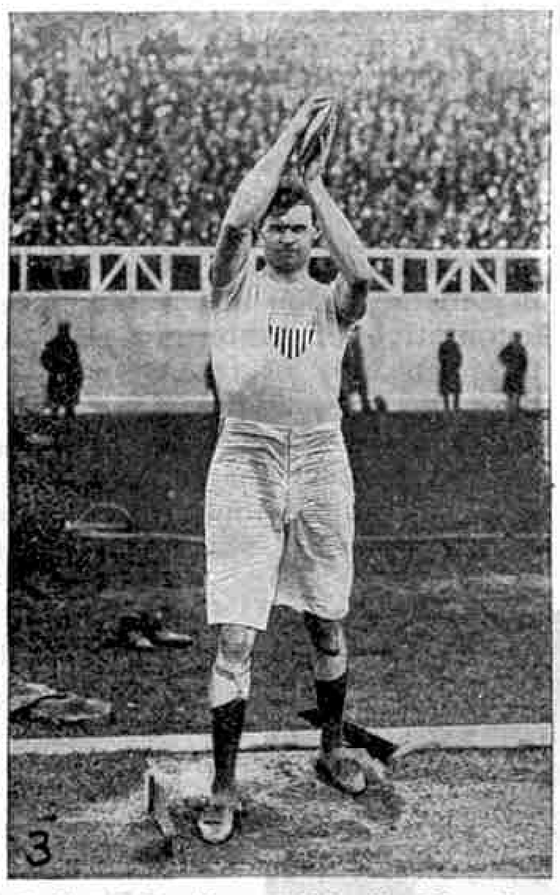
By F. A. M. WEBSTER
(Fredk. Warne & Co. Ltd. 12/6)

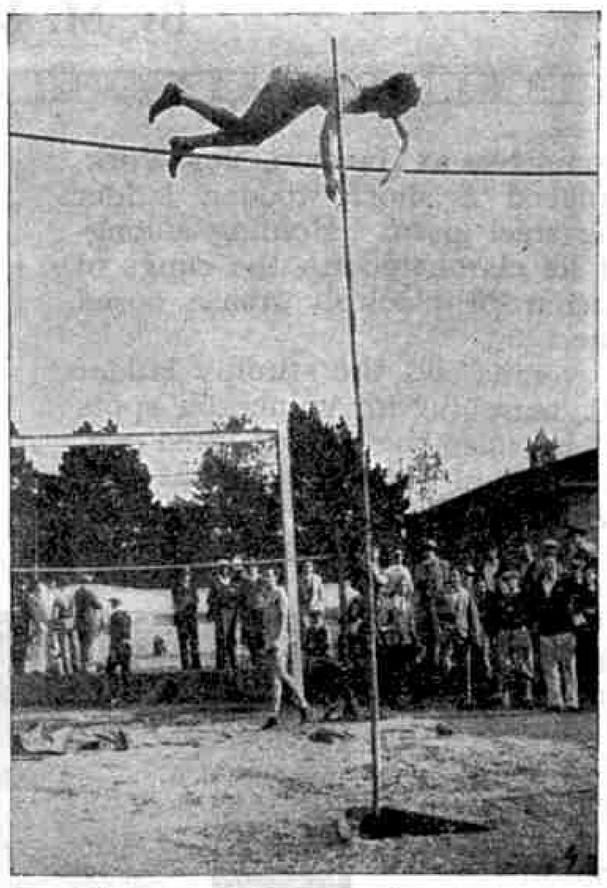
The publication of this book marks an important event in athletic history. The publishers claim that nothing so entirely comprehensive has been attempted for at least ten years. Captain Webster, the author, has not only won his laurels in the field of sport but has made a careful study of the athletic technique of the great contenders for world championship honours. He also had much to do with the making of H. A. Simmons, that wonderful schoolboy high jumper from Southampton, who is the youngest athlete to have represented any nation at the Olympic Games. As a lecturer on Athletics, Captain Webster is well-known and the schoolboys and young soldiers who have been coached by him to their advantage are legion.

The book provides an authentic history of the development of athletics throughout the world since championship meetings were first instituted. It contains a wealth of athletic instruction that is made clear by over 200 action photographs. It is divided into three parts: Growth of Modern Athletics; Track Events, their History and Practice, and Field Events, their History of Practice. There are in all 23 chapters and the book runs to 368 pages. It includes a very useful appendix of world and other records as well as a comprehensive index.

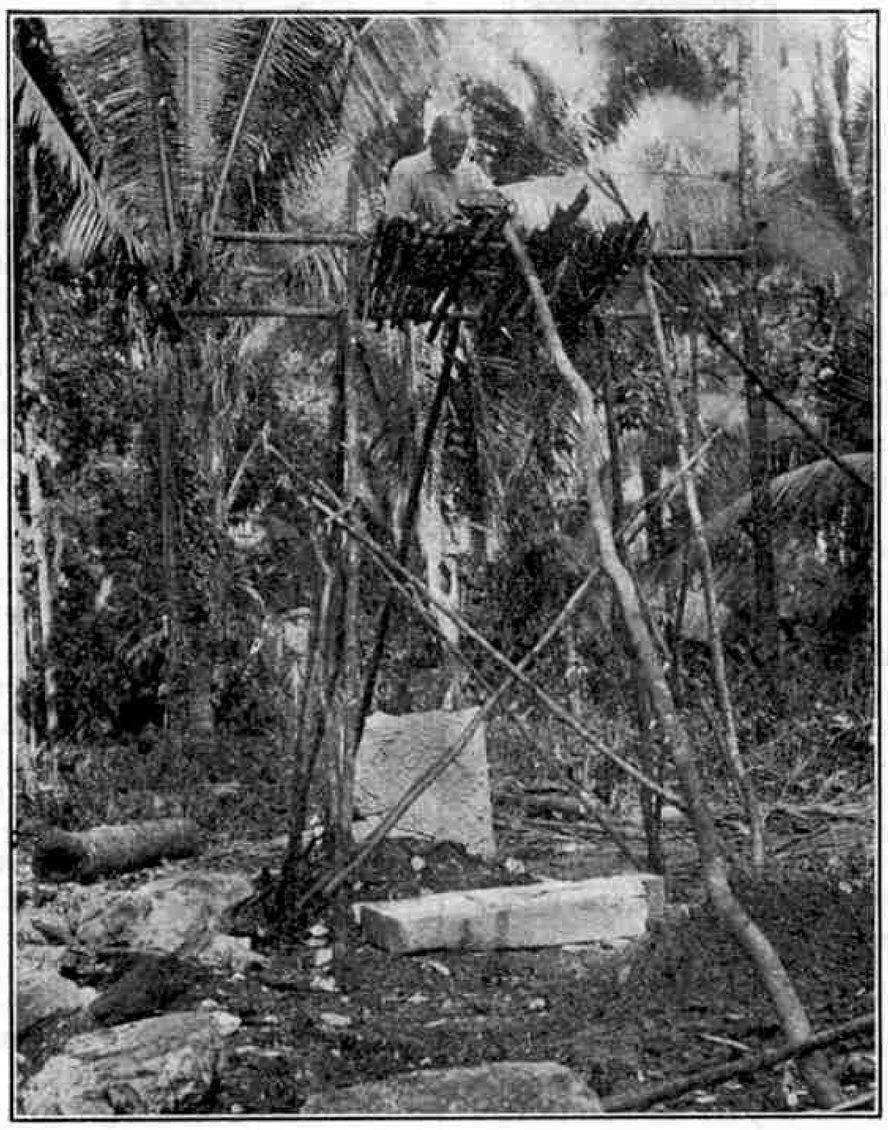
We have no hesitation in recommending the book to any of our readers interested in the subject. As Lord Burghley, the Olympic and British Hurdles Champion, says in his Foreword, "I strongly advise all would-be athletes, and particularly Field Events men, to read this book; and I can assure all those who are in any degree interested in Athletics that they will find the stories of great races and the anecdotes of great runners most entertaining."

A recommendation from such a famous athlete is indeed valuable.





(Left) M. Sheridan, U.S.A., the Olympic and world's record holder, showing the starting position in throwing the discus. (Right) Lee Barnes, U.S.A., vaulting 13 ft. in the pole vault. These two illustrations are from "Athletics of To-day" by F. A. M. Webster, reviewed on this page



Taking photographs from a platform of sticks in the bush. An illustration from "Discoveries and Adventures in Central America" to be reviewed next month

New Colour Plate of "*Flying Scotsman*"

The L.N.E.R. have issued a new print in colour of the "*Flying Scotsman,*" No. 4472, to replace the previous print. The new reproduction is a decided advance upon the earlier one, and in regard to colour and detail is a really first-class piece of work. L.N.E.R. enthusiasts will be interested to see that the print shows the new style of lettering and numbering. Copies may be obtained from all L.N.E.R. offices and station bookstalls at 1/6 each including a cardboard tube for postage.

"Sea-Lore"

By STANLEY ROGERS
(Harrap & Co. Ltd. 7/6 net)

Mr. Rogers has very usefully followed up his first book, "*Ships and Sailors,*" by the present volume, which discusses in an untechnical manner various aspects of life at sea in the old days of sail. He commences with an interesting description of the different types of sailing vessels, and his account of the different characteristics of each is one of the best we have read. Under the heading "The Family Tree" the author takes us back to the days of the Egyptian vessels, and traces the gradual development of the sailing ship throughout the ages.

From the ships we come to the men who handled them, and two chapters are devoted to famous navigators, from Columbus to Captain Cook. In describing the exploits of these men the author brings into prominence their splendid courage and determination to achieve what they had set out to do. A particularly interesting account is given of the greatest of all 18th century seamen, Captain James Cook. The mere list of this navigator's achievements is bewildering. He seems to have been everywhere, and he probably has contributed more than any other man to maritime knowledge.

Mr. Rogers breaks new ground to a large extent in his chapters on sea language and sea superstitions. In the former he deals with many of the most interesting words and phrases concerning the sea and ships, and points out many of the errors into which a landsman is liable to fall. It is interesting to learn that in the time of Columbus seamen thought that if they got into the trade winds they could never return; they believed that these winds were sent by the devil to blow them over the edge of the world! The custom of measuring time at sea by "bells" instead of hours dates back to the days when a sandglass was used. The sand took half-an-hour to run through, and a boy used to be stationed to turn the glass over every half-hour, at the same time striking a bell. The remainder of this fascinating book is devoted mainly to an account of some of the most famous ships of bygone days, and of lost ships and lost treasure.

The illustrations, of which the book contains a considerable number, are from excellent drawings by the author.

Running the World's Greatest Engines

Taking Over the "Twentieth Century" and Bringing in the "Empire State Express"

By M. Martin

UP in that playground of big locomotives at Harmon, New York, a blue-coated engineman placed a short wooden ladder against the side of a panting steel giant. Holding a long-spouted oil can in his right hand he clambered up the rungs of the ladder. From the can a stream of blackish grease oozed lazily into the veins of the engine.

Slowly the man in faded blue overalls slid the stumpy ladder along the flanks of the supine beast, searching for vulnerable spots in its metal armour. Four times he filled the long-spouted can, emptying it each time into new parts of the giant's anatomy.

The job finished he hurried to his place behind the throttle. There was a snort, a low whistle of escaping steam and almost imperceptibly the mass of machinery moved out toward the spur track leading to the main rail line between New York and Buffalo. Down the track boomed the "crack" train from New York shedding its bob-tailed electric engine as it came to a halt. The coal-burning locomotive glided to place. A conductor walked briskly down the platform and stopped under the cab window.

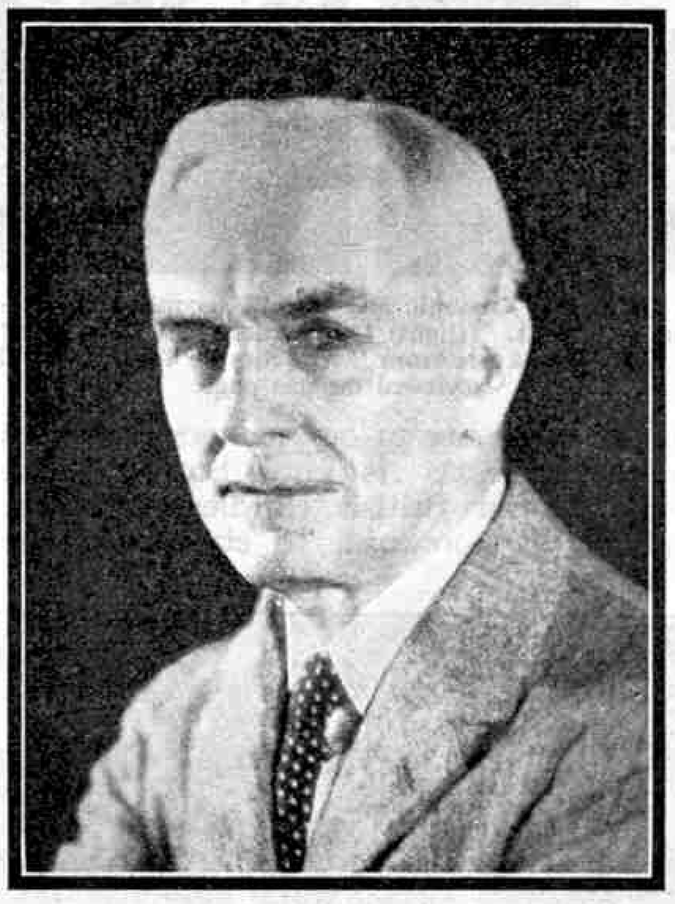
"Hello, Bob," said the gold-braided one, taking out a watch and holding it up for the engineer's inspection. "Time all right?"

Bob nodded, watch in hand. Then with eyes straight ahead and visor cap pulled low, he settled back stolidly in his seat. Across the narrow engine cab Jim, the fireman, taking his chief's cue, sat at attention in his padded leather niche.

"All aboard!" sang the autocrat in blue broadcloth from the station platform.

The unsmiling engineer touched a shining brass handle. The great wheels began to turn. The Twentieth Century was off on the first lap of its daily run to Chicago with "Bob" Butterfield, star engineman, at the helm.

The last person you would expect to talk romance is a locomotive engineer. Yet Butterfield talks it about the "she" that has been his pride and joy for four decades. Bob is the grizzled veteran who four times a week takes out the fastest long-run train and brings back the fastest short-run train in the world. "She" is the locomotive whose achievements far surpass her whims. The latter occasionally perplex an engineer, but the former are sure to gladden his heart—that is, "if he treats her right."



Robert E. Butterfield, a "star" driver on the New York Central Lines

Robert E. Butterfield is one of the five oldest enginemen, in point of service, on the New York Central Lines, having started work for that company when he was sixteen. Young Butterfield did not dream as he shunted his old-fashioned switch engine up and down the slow-moving New York of the eighties that he would one day handle one of the world's fastest and most famous trains. He recalls General Grant's funeral procession as one of the great sights of those early days. From his engine cab window, the young railroader watched the cortege wend its way to the granite tomb on Riverside Drive.

105 miles an hour down the Hudson Valley

Step by step he climbed from apprentice boy to machinist helper, to fireman, to engineer. He was already a "star" man when the haughty Twentieth Century Limited began its startling eighteen hour runs between New York and Chicago. He was included in the picked crew selected to pilot the million dollar train on her first journey west. Newspapers of twenty years ago featured Butterfield's sprint down the Hudson River valley at a record of 105 miles an hour. "She could have made 111 miles," he proudly confided the other day at his pleasant home in Ossining, New York.

The grey-haired railroad man was getting ready to start for the nearby village of Harmon where he picks up the Century as she deserts her electric engine for the coal burner that takes her through to Chicago. This new £20,000 coal-burning engine is, according to Engineman Bob, the finest one ever made. Over a substantial lunch of roast lamb, vegetables, salad, apple pie and cheese, in the Ossining home, the rugged sixty-year-old reviewed some tales about engines and engineers and railroading in general. Bob has a good deal of sentiment about the modest locomotive of yesterday that he has watched mature into the proud beauty of to-day, whose cross-country runs are followed by potentates and nations. It is his child, and like all parents he is pleased when the world applauds that child's accomplishments.

"You know you get to love your engine," he said with a shy smile as he sat down on a divan beside his visitor in the sunny living room. "You have to study her. She has moods, just like all of us. You must get acquainted with them. Humour her a little now and then. She'll never disappoint you if you treat her right."

So might Mark Antony have pondered the moods of his beautiful Cleopatra. Study her! Get acquainted with her!

The "little whims" of a locomotive

"Find out all her little whims," continued the veteran. "She has them. Each engine has different ones. It takes time to learn them all." He admits it is not always easy to know just what is wrong with her when she is in contrary mood. Long before he is due to leave on the daily run Butterfield is at the Harmon roundhouse where the great locomotives are stabled.

"I like to have plenty of time to take her out myself and look her over before we start off. In old days an engineer took entire charge of his engine. No one but him was allowed to touch her. My, how those engines used to shine."

But times have changed. Gone is the smiling engineer with a piece of waste in one hand and an oil can in the other, mulling over the tantrums of his engine. The efficiency expert has taken his job away from him. To-day there are all sorts of new devices to condition those swift steeds of steel that propel the cross-country flier. An army of oilers and skilled mechanics are on hand to groom them and rub down their sleek sides after each race. Though the locomotive jockey may prefer to keep an eye on his pet, he has a hard time doing it. One gathers that Engineman Bob does not like it when a strange engine comes back to him from Chicago and he has to bring her down to Harmon from Albany. Even engineers have their favourites.

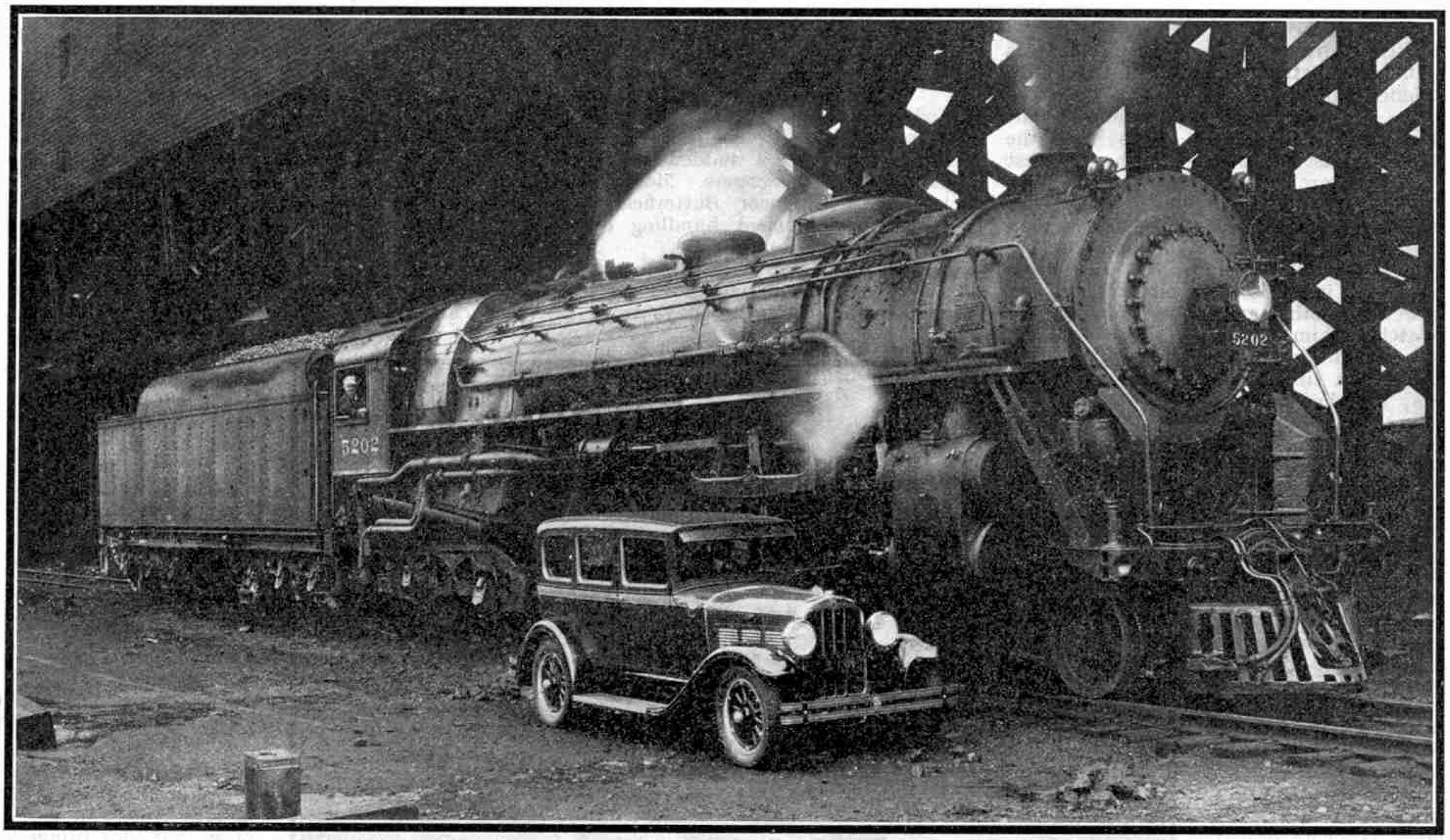
"Don't push her too hard," he counsels. "You get to know where she will do her best. Coax her along. Then when she's running smooth, give her the steam."

Bob Butterfield has given many an engine "the steam." Most old travellers up and down the Hudson River valley know this keen-eyed man and call him by his first name. Many of them walk up to his cab to shake his hand and pass the time of day.

In the Harmon railroad yards he told more about those early engines on which he learned much of the skill that has placed him among railroad stars. Pygmies they were, those engines, compared to to-day's six hundred thousand pounders.

"When an engineman went out in those days he never knew when he'd get back home. A sixteen-hour day was a short day. You stayed with your engine from the time she left the roundhouse till you brought her back to it. Had to keep her clean, too. Take all the care of her. We used to scrub her out with soft soap. Then go all over her with hot oil. She was sure a pretty sight when she was all shined up. Every engineman took great pride in his engine." Bob always calls an engine "her," never a locomotive.

To-day an elaborate system has replaced the soft soap and hot oil of the past. In the Harmon yards a dozen washers, hose in hand, were busy spraying the sides of the great steel giants,



impatiently waiting for their cues. Wipers followed the washers. Experts were testing the automatic coal chutes that feed the roaring red fires in the stomachs of the giants, fires that in a second would make a cinder of a dinosaur. Other experts were testing all manner of mechanical devices—valves, air brakes, water gauges, levers. The keyboard of a modern locomotive has as many stops and keys as a cathedral organ. It takes a master hand to play them all with proper tempo.

"Fool proof, they are," said Butterfield, mindful of the days when there were no fancy labels on coal chute and water-pipe. And he recited a long list of new-fangled appliances that control the last word in engines, the "Hudson."

He was guiding his visitor through the maze of tracks at Harmon, that little village planted on historic ground along the Hudson River. Like a gigantic steel spider web the tracks spread out in all directions. Along the metal threads of the web, large engines and small ones spun their course. There were patrician passenger locomotives, proudly patronizing, in shining new black robes. There were less arrogant engines that propel the humble freight. Eighty engines leave this yard each day and come back again. A new roundhouse, looking as though it could comfortably house all of Cæsar's chariots, is nearing completion—a perfectly appointed rest room and beauty parlour for twenty or more convalescing locomotives, with a staff of beauty specialists in overalls and denim caps in attendance.

The illustration above shows the immense size of the new Hudson type locomotive in comparison with a saloon car.

The engine illustrated in the above photograph is No. 5202 and "Bob" Butterfield, the veteran driver of the Twentieth Century and the Empire State Express, is seen in the cab.

Handling the new "Hudson" Monster

The new Hudson type was there glowering down on its less *chic* sisters. A spoke in one of its wheels is taller than the tallest man. Its squatty smokestack tops a cylindrical body large enough to encompass a small bungalow. In its tender it carries twenty-four tons of coal and 12,000 gallons of water. No delays picking up coal on this efficiency breeder. Superheated steam increases its speed, a speed that it is said could lower the old New York-to-Chicago record of eighteen hours. There is a five-chimed whistle and a bell with a pneumatic rapid clapper.

Butterfield turned a handle and the beauty moved forward as gently as a Colonial dame drifting across a ballroom floor. He turned the handle back and the beauty stopped without fuss or flutter.

"Any bloke can stop a train with a jar," he said. He didn't. "These new engines make life easy for the engineman," he continued. "Nothing to do but push buttons." And there they were spread out close at hand on a huge switchboard. Each push button labelled in black letters on a white disc.

Butterfield is an old-fashioned engineer on a new-fashioned job. He combines good old habits with approved new ones. Men half his age are entering the field to-day. But they have not learned their trade tricks in the hard school that gave this veteran his painstaking habit of keeping an engine ship-shape. His was a long, practical grind. Theirs is a short technical drill. They call themselves engineman, not engineers. Bob is still just a plain engineer.

To the uninitiated the shining black steed Engineer Butterfield took out that day appeared to be in perfect condition. But apparently it did not quite satisfy his sense of neatness. For all the way across the yard to where he picked up the Century, Bob was busy with a piece of waste. Not a handle, or a button, or a piece of brass, that did not receive its vigorous scrubbing. No nervous tremors about the break-neck speed he would launch when the Twentieth Century came under his charge. No thought of accidents; Butterfield never mentions them. Only the layman thinks of accidents on fast trains. Incessantly he polished and rubbed, scoured and cleaned, until every piece of brass and metal in that engine shone like a fireman's helmet. Apparently the men who picked Bob Butterfield to be the guardian of one of the highest-priced trains in the world knew their man.

Butterfield was born in New York City and has lived in the state all his life, the last fourteen years in Ossining

He has worked for only one railroad, the New York Central, and he has never been out of a job a day in his life. His training was in a twelve-hour-a-day school and he went to work for seventy-five cents a day. To-day as engineer on a "star" train his hours are short, shorter than they used to be. For railroad officials found some time ago that the strain on enginemen was heavy. Eight shifts are now made in engineers and firemen between New York and Chicago on the fastest train. And engines are changed four times. Even with frequent shifts some men find it hard to stand the grind.

"They quit," said a railroad official not long ago. "Automobiles shake their nerve. The chances automobilists take crossing tracks ahead of the engine rattle them. They come in here and give up the fast trains voluntarily."

Engineer Butterfield never hit an automobile. But, he claims,

one once hit him.

"Ran into my second car." There is a fine distinction here that the technical minded will appreciate.

In his tweed suit and white collar, Robert E. Butterfield looks like the average business man—a rather modest business man at that. But when he slips on his overalls, pulls down his goggles and steps to the throttle, the business man disappears. Butterfield becomes the big boss. Very little escapes his bright grey eyes. He is small, wiry and swift moving, with smooth-shaven ruddy cheeks. Watching him bound up a flight of steps three at a time, it is easy to believe he has never been sick but once in his sixty odd years. He looks forward with small pleasure to the time when he will be "put on the shelf," as he terms it. The New York Central, in common with other railroads, automatically retires its employees at seventy. But this engineer is much too young at sixty-three or four to be possibly old or inactive at seventy.

A hearty mid-day dinner is his only heavy meal. When he returns at nine-thirty in the evening from the Albany run, he eats a bowl of crackers and milk and goes to bed. His breakfast, an early one even on off days, consists of coffee, toast and an egg. He has no hobbies. He claims he gets all the exercise he needs taking care of the Ossining house and grounds. There is grass to cut, flower beds to weed and a grape arbor to prune. When Mrs. Butterfield goes to their summer camp, Engineman Bob cooks his own meals. He does not like restaurants and rarely eats in one. His youngest son is in college. His other three children are married and have homes of their own. His three young grandchildren are his best playmates and come to see him almost every day. They are handsome children and Bob is susceptible to beauty in humans as well as in engines, although it is about an engine that he oftenest says, "Ain't she a beauty?"

To this engineer there are no dangers in railroading. He believes the fast trains are just as safe as the slow ones. He has never been in or near a serious wreck.

"Ran through a freight train once," he acknowledged, "but nobody was hurt. The freight was switching ahead of us; broke apart in the middle. We went right through those cars. Stripped off the left side of my engine. Some of the passengers didn't even know there was a wreck till we stopped."

Another time Butterfield's train was hitting a seventy-mile speed when a man suddenly jumped out of a snowbank just ahead of the engine and waved a flag. Bob threw on the brakes and stopped the train within the length of twelve cars. (A feat, according to railroad men). The man proved to be a brakeman who had been left behind by his own train, a freight, when he got off to wave all clear. He did not know he was flagging one of the world's fastest trains.

"Throwing the brakes" requires skill and long practice. There are times when even the dextrous engineer cannot bring a fast train to a sudden stop without jarring the passengers. Most of these jars, says Engineer Butterfield, can be avoided by efficient handling of valves and cut-outs.

Though his cab may be snug and ship-shape, all is not smooth sailing for the engineman. There are days when heavy fog lies over the land. There are nights when blinding rains shut out the road ahead. These are the times that try him. With straining eyes he rounds the curve that he knows conceals a signal. If it is green he knows all is clear ahead. It may be yellow. Yellow means caution.

"It's a sign we engineers hate," said Butterfield who loves speed. "For if the next signal says all clear, we've lost time." He threw up his hands. All railroad men from the president down know what it means when the crack train is "somewhere out there" losing time. Things are hectic in every branch of the service then.

"A second!" snorted Engineer Bob when questioned about the minutes that might elapse before a fast train can be stopped in an emergency. "Why, a fifth of a second is a lifetime when there's danger ahead. She'll run eighty-eight feet in a second. And eighty-eight feet is too far when a signal comes to stop."

Strange things sometimes happen on the railroad. There was the little house on a hill just above the signal post of a railroad, the signal all enginemen watch with feverish eyes and taut nerves. One night a light appeared in the window of the little house. The night was dark and foggy. Along came the fast train eating up the miles as it careened round a bend in the road. The engineman leaned from his cab window. Yes, the light was there. All was clear. The snorting locomotive zoomed past. There was a grinding of wheels and then a crash. It was not the signal post light the engineer had seen. It was the little house on the hill. The road ahead was not clear.

What if an engineer cannot see the signal light! "There is no can't," said Bob Butterfield soberly, "he *must* see the signal."

But as Engineman Bob puts it, the modern engines and the new-fangled appliances and controls are fool-proof. To-day, although an engineman drops dead at the throttle, his engine stops if it runs on to a dangerous stretch of track. A new safety device now manipulates that track so that it automatically stops an engine passing over it. There are still dangers in railroading. But they are growing fewer.

"She'll never disappoint you if you treat her right," the old engineer had said. "Coax her along. Then when she's running smooth, give her the steam. When last seen Bob Butterfield was doing just that.

* * *

This interesting article, for which we are indebted to the "*New York Central Lines Magazine*," not only describes graphically the day's work of a driver of a world-famous American express, but also brings into prominence many of the essential differences between American and British railway practice. The "*Twentieth Century Limited*," which works daily over the 978 miles between New York and Chicago, is so popular that it is generally run in four or five sections.—EDITOR.

The Boston-Chicago "*North Shore Limited*," hauled by one of the Boston & Albany Railroad's powerful "Pacifics"

Harnessing Niagara River—

(*Continued from page 676*)

electrical energy needed by an industrial city of nearly 2,000,000 for its factories, street cars and elevators, and all the electrical services for business and domestic purposes.

Naturally the existence of such a wonderful source of natural power as Niagara Falls has greatly encouraged the use of electrical power in the surrounding country, and the network of overhead transmission lines from the stations controlled by the Hydro-Electric Power Commission is rapidly spreading in all directions. Perhaps the most remarkable application of the current is in rural districts. The fortunate farmer in South Ontario chops feed for his cattle with the aid of an electric motor, milks his cows and separates cream by electrical means, in addition to making use of current for the usual lighting and heating services.

Another sphere in which electricity has been of great benefit to the inhabitants of the rural districts has been in supplying convenient power to local industries. In almost every rural district in Ontario there are now several industries whose plants are operated by electricity.

On the Niagara river, the water available under the terms of 1909-1910 Treaty is practically all in use on both sides of the boundary, and no further power development can be made until the present Treaty allotments are increased.

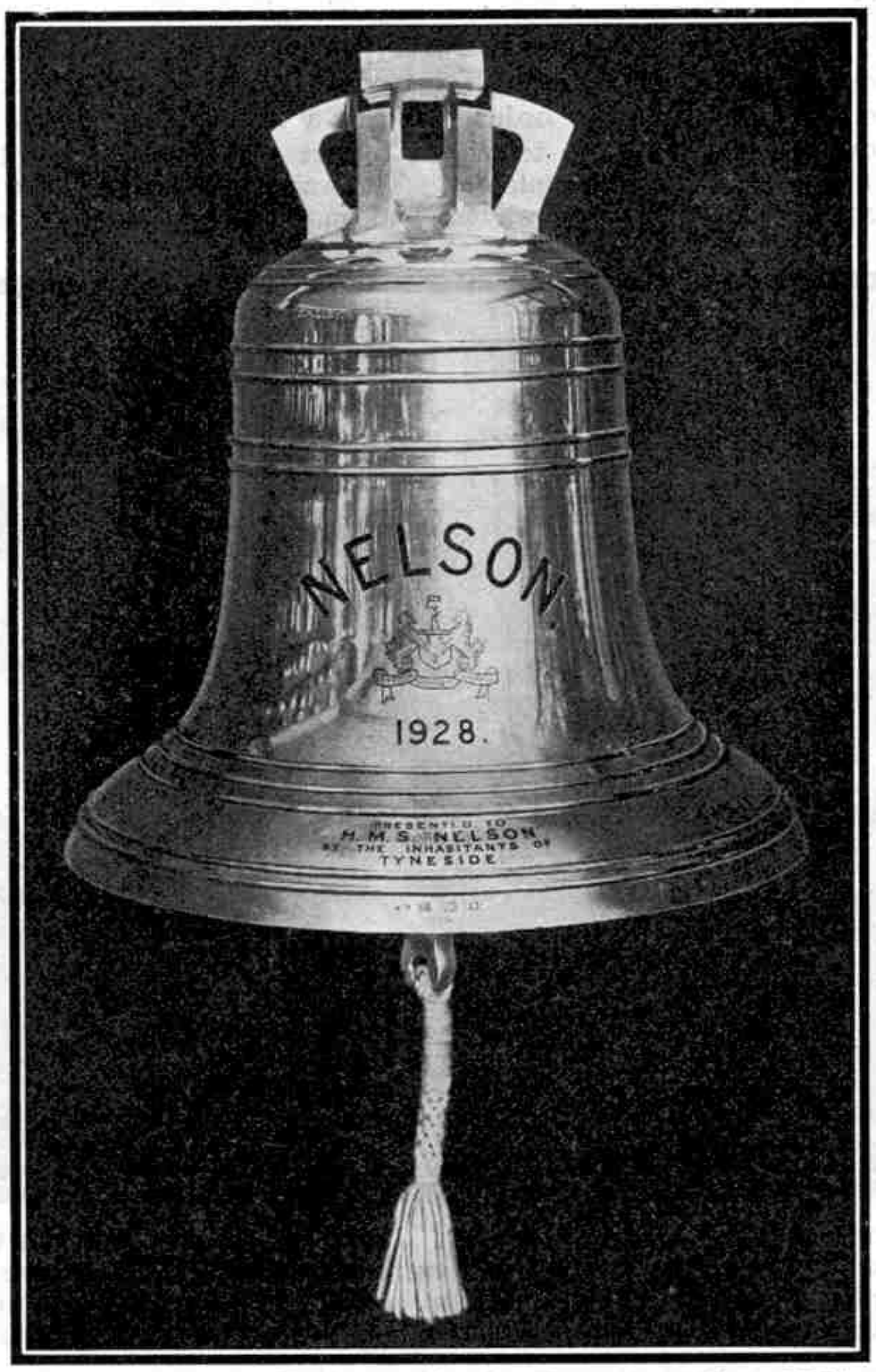
The Largest Silver Bell in the World

An Interesting Presentation to H.M.S. "*Nelson*"

AT different periods in their long history bells have been made of a great variety of mixtures of metals. Nowadays the great majority are made of a carefully proportioned mixture of copper and tin, but occasionally for special purposes bells are cast entirely of silver. The largest silver bell yet made was installed last year on the new British warship H.M.S. "*Nelson*," and was a gift from the people of Tyneside in commemoration of the building of the vessel at Newcastle.

This interesting bell is 1 ft. 7 in. in height and 2 ft. in diameter, and is fitted with a clapper 3 in. in diameter. More than 7,393 oz. troy of pure silver were melted down for casting purposes, and it is of interest to note that during this process only 61 oz. of the metal were lost—that is, less than one per cent.

The mould for a bell is made in two portions, which are known respectively as the outer mould or "cope," and the inner mould or "core." The cope is made up of a number of cast-iron sections bolted together, while the core is of brick built upon a cast-iron foundation, and is of slightly smaller diameter than the cope. The inner side of the cope and the outer side of the core are shaped to the contour of the bell, and are coated with loam which, by means of a specially designed rotating board, is shaped and smoothed until the form of the bell has been accurately produced in the mould.



The World's Largest Silver Bell, that has been presented to H.M.S. "Nelson" by the people of Tyneside in commemoration of the building of the vessel at Newcastle. The bell was made by J. Stone & Co. Ltd., Deptford, to whom we are indebted for the above photograph

A specially prepared loam was used in making the moulds for the bell for H.M.S. "*Nelson.*" The furnace was heated with specially selected sulphur-free coke, and the silver was melted in new graphite pots. This operation was supervised throughout by an expert chemist who, with the aid of an instrument known as a pyrometer, which indicates the temperature of the metal, decided when the exact moment had arrived for pouring.

The metal was then poured into what is known as a "runner box," which is placed at the top of the mould, the runners connecting to it feeding from the bottom of the mould. The molten silver was collected in the runner box, but was prevented by a ball valve from entering the mould until nearly the whole of the silver was transferred from the pots. The valve was then removed, and the silver entered the mould with considerable force, thereby ensuring that it would reach all parts of the mould before "freezing" or setting took place. This point required special attention, as silver sets very rapidly. In addition to the runner box, two large square "risers" were placed at the top of the mould, and into these the surplus metal ran.

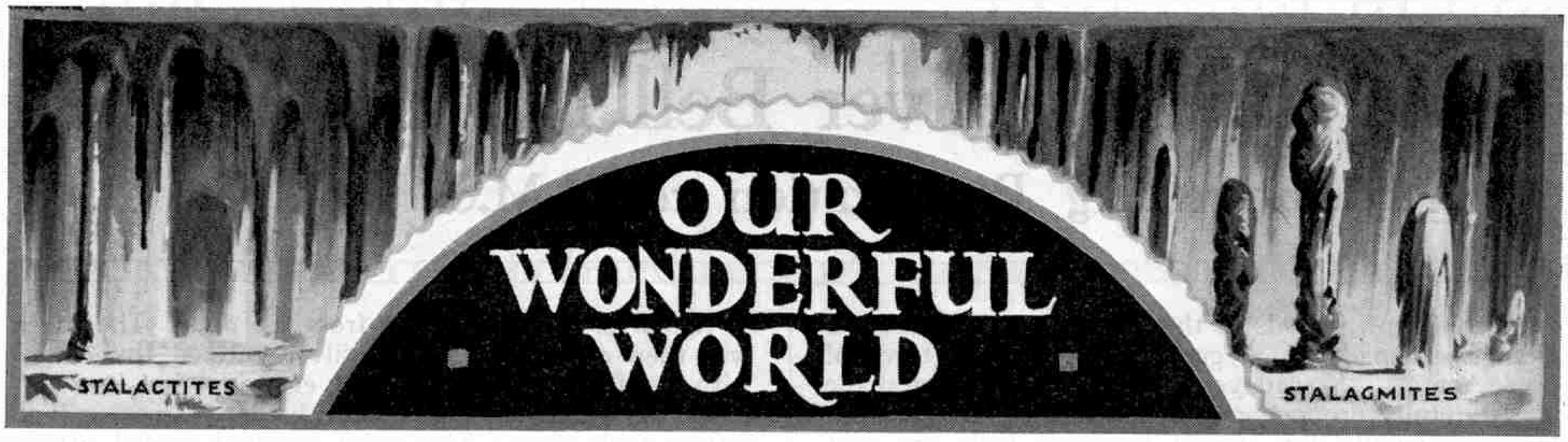
The mould was removed a few hours afterwards, and the casting was found to be perfect. The "runners" and "risers" were then removed in the trimming shop, and the bell was transferred to the machine shop for turning to the correct size and weight.

The clapper of the bell was also made of solid silver and in two pieces, the striking portion being cast and machined, and the rod being forged with a hook at one end and screwed at the other for connecting to the striking portion. The eye on which the clapper hangs was cast and machined, and screwed into the crown of the bell.

During the manufacture of the bell special precautions were taken to guard against any undue loss of metal. The casting was trimmed up on a specially cleaned floor covered with paper, and all filings and chippings were carefully swept up. The lathe on which the bell was turned was enclosed with boarding lined with paper, and each day all drillings were swept up and transferred to a safe. The filing and burnishing of the bell was done in an open-topped box lined with paper.

The bell was presented to the Commander of the Atlantic Fleet by the Lord Mayor of Newcastle, and after the ceremony it was conveyed through the streets of the city on a gun-carriage, hauled by men of H.M.S. "*Nelson*," to the quayside, whence it was taken down-river to the warship at Jarrow Slake.

Another silver bell, of slightly smaller dimensions, has been made recently by the same firm. This bell was a gift from the people of Sussex to the British warship that is named after the county, and it was publicly presented to the vessel at Portsmouth by the Lord-Lieutenant of Sussex.



Commercial Materials Made From Straw

A special edition of an American weekly has been published on paper made from corn stalks reaped six hours earlier. Almost simultaneously, 260,000 copies of a well-known agricultural journal called the "*Prairie Farmer*" were printed on similar paper, thus completing a movement "from the farm back to the farm." A book devoted to the application of farm products in industry also has been printed on paper made from corn stalks.

The material from which this book was made was harvested on farms near Chicago, and the pulp made from it was converted into paper on machines that ran without a break for nine hours and produced paper at the rate of 500 ft. a minute.

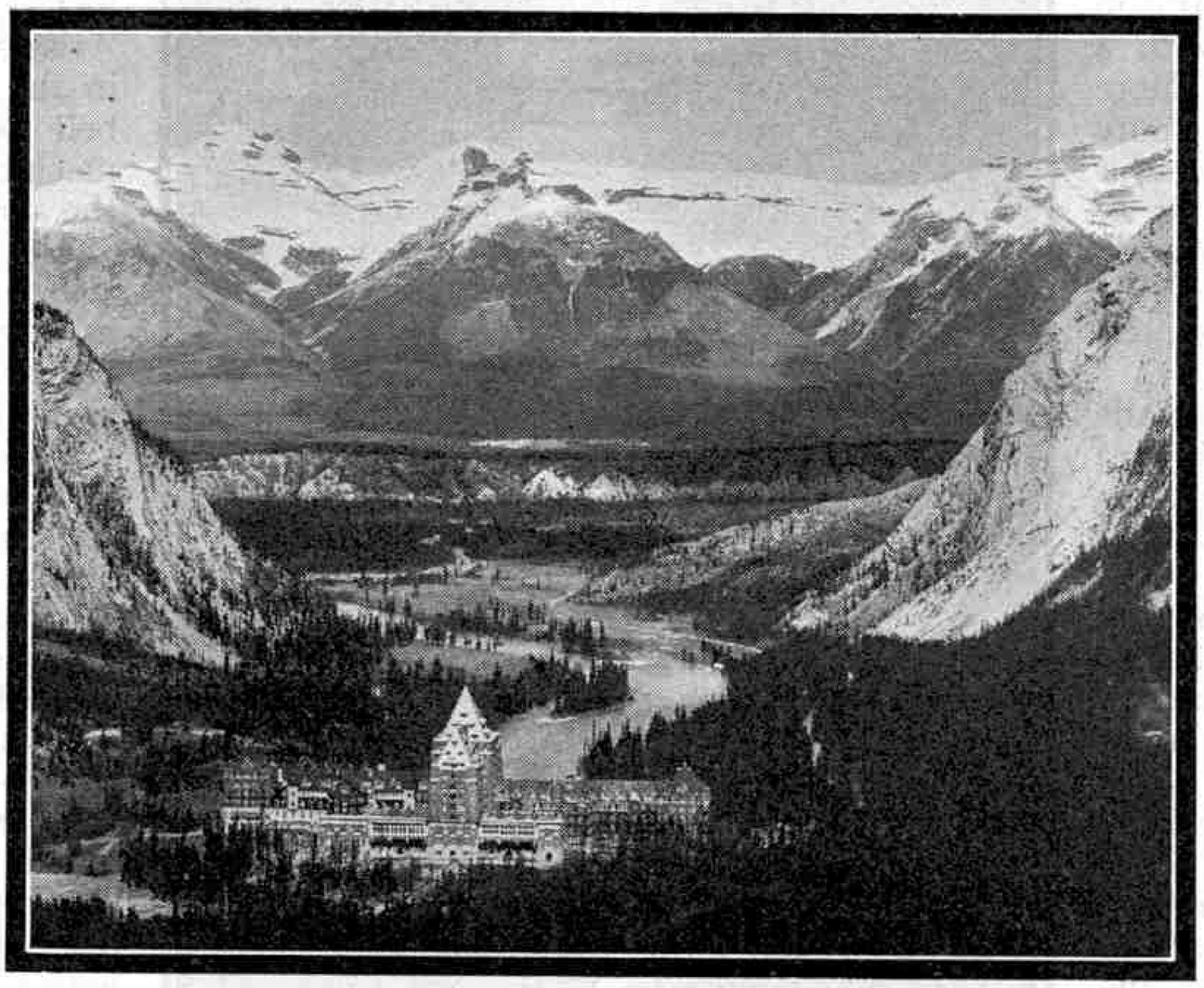
Corn-stalk paper is very strong, and resists tearing better than sheets made from ordinary wood pulp. Its introduction draws attention to the many uses that are now being found for farm products that formerly were wasted. Straw promises to become almost as valuable as coal-tar, and already it rivals that wonderful by-product in the variety of commercial materials that may be obtained from it. Its chief constituent is cellulose, which has been proved to be suitable for use in the production of oils, glycerine, artificial silk, leather substitutes, photographic films, gum and other adhesives, wall boards, insulating material and an endless variety of chemicals. A ready market is available for practically all these products, and it almost seems as if the day is approaching when farmers will reap as much profit from straw as from the grain it carries!

The chemist is not content with the long list of straw products already quoted, however, and experiments are now being made in order to discover how to turn it into coal. Nature took millions of years to transform the cellulose of prehistoric plants into our black diamonds, but a German scientist claims to have accomplished the feat in 24 hours by heating a mixture of cellulose and water to 640°F. If his claim turns out to be well founded, we shall be able to grow coal instead of digging it out of the earth!

Murder by Telephone!

Sooner or later a sensational novelist will read of the discovery of sound waves that kill, and will introduce them into his books in order to stage a mysterious "murder by telephone" that will baffle the police completely. The waves referred to are sound waves, and may be transmitted through the air or through other materials in the ordinary manner. The only difference between them and the waves that produce harmless noises is in the rapidity of vibration.

In order that a sound wave may produce the highest note that can be heard by the average human being, the number of vibrations of the particles of the air through which it passes must be about 40,000 per second. The dangerous sound waves have a much greater frequency, and do not produce any audible sound. Their effects are remarkable. It is stated that they will burn a man's fingers, kill small animals, break glass, cause explosions and evaporate liquids. When they are turned on a glass vessel containing pure water, the liquid becomes milky in appearance because they tear minute particles of glass from the sides of the vessel.



In the heart of the Canadian Rockies! The Banff Springs Hotel in the foreground of our photograph is in the centre of a National Park nearly 6,000 square miles in extent. The wonderful scenery of this mountainous region has been described as equal to that of 60 Switzerlands rolled into one!

Wood as a Food of the Future

Many strange uses have been found for wood since it was replaced by coal as the world's chief fuel. We have always been accustomed to its employment in building and in furniture making, and we come into daily contact with it through our newspapers, the paper of which is made from wood pulp. It is also being used on an increasingly large scale in the manufacture of artificial silk, and clothing made from it is displacing to an appreciable extent that made from wool and cotton.

Now we are threatened with food made from wood. This is the production of Dr. Bergius, a German chemist, who has already achieved fame by showing how to turn coal into petrol. The new food is a flavourless product that is rich in carbohydrates and has already been used with success as a cattle fodder. Dr. Bergius thinks that his invention may displace corn as an animal food in Germany, as it can be made very cheaply from waste wood, straw, or the shells of nuts. It is only necessary to remove certain impurities from this synthetic food in order to make it suitable for human use.

The prospect of living on wood may not be very alluring, but to a chemist there is really nothing remarkable in the suggestion! Its chief constituent is cellulose, which is related to such well-known foods as sugar and starch, and the chemical changes that Dr. Bergius makes transform it into a substance that may be described as being halfway between the two.

* * * *

Well that Supplies Hot Water

At Capa, a small town in South Dakota, U.S.A., is a well from which hot water gushes at the rate of 100 gallons per minute. It was bored in order to provide water for the boilers of locomotives, and the high temperature seemed to make the product very suitable for this purpose, but unfortunately the water is not sufficiently pure. It has been put to good use, however, for it is now run through pipes in order to heat the waiting room of the station. The temperature of the water is about 120°F., and it gives sufficient heat except in the most severe weather.

A Wonderful Lightning Photograph

The photography of lightning is an exciting and uncertain affair. It is impossible to use a shutter in the ordinary way, and all that can be done is to leave the lens open and direct the camera towards the portion of the sky where the flashes are occurring—at night, of course. The accompanying photograph is a very remarkable one, and shows that the storm was one of great violence.

Lightning is an electrical discharge between one cloud and another or between a cloud and the earth, and the photograph illustrates splendidly the forked or zig-zag nature of the discharge. This crooked course is the result of the discharge taking the path of least resistance through the air. The familar "sheet" lightning is probably the reflection, from the lower surfaces of clouds, of forked lightning discharges taking place at a distance.

Various other forms of lightning have been described from time to time, but imagination seems to have played a great part in the description of many of them. One remarkable form known as globular lightning has been seen beyond doubt on a few occasions. In this case the discharge takes the form of a globe of light that moves slowly along and finally disappears with an explosion. The explanation of this is not understood, but it is possible that the ball consists of intensely heated fragments of matter torn off by the violence of the lightning discharge.

A Wonderful Flash of Lightning. (See accompanying paragraph)

* * * *

Do Flying-fish Really Fly?

A problem that has long occupied the minds of experts is the manner in which a flying-fish travels through the air. Some have argued that the fish merely leaps out of the water and for a brief period is supported in the air by its wings; others assert that it beats its wings and really does fly.

A flying-fish that landed on the deck of the "*Aquitania*" during a recent voyage seems to have settled the dispute. The deck is 40 ft. above the water-line, and no fish could acquire sufficient momentum to enable it to leap to such a height. It thus appears that the fish actually flies, and that the beating of its wings has notbeen detected because they vibrate too quickly.

As a rule a flying-fish seldom rises more than a few feet above the water and the achievement of the enterprising visitor to the "*Aquitania*" is extraordinary.

* * * *

It is estimated that every day the Earth is bombarded by no fewer than 1,000 million meteorites! Fortunately the majority of these projectiles are exceedingly small. On an average it would take 450,000 of them to weigh a ton, and they are quickly burnt up by the frictional heat produced during their passage through the atmosphere.

Thermit Bombs to Blow Up Icebergs

Every year millions of dollars and many lives are lost, chiefly in North America, in floods that follow the breaking up of the ice on frozen rivers. The floes are carried down stream, and often pile themselves up against obstructions and thus prevent the flow of water. Usually attempts are made to release the ice dam by exploding dynamite in its midst. This has been fairly successful, but better results are given by the use of thermit. This is a mixture of iron rust and powdered aluminium that becomes white hot when ignited, the temperature rising as high as 5,000°F. The ice is changed into steam so quickly that an explosion occurs, and on one occasion a mass calculated to weigh a million tons was scattered by exploding in its midst two charges of thermit each weighing 90 lb.

From ice jams to icebergs is a very natural step, and the inventor of the thermit method, Professor H. T. Barnes of Montreal, decided to try to blow up an iceberg by this means. For his first trial he chose one that was nearly 100 ft. in height. Into a hole bored just above the water line he placed 160 lb. of thermit and fired the mixture with a slow-burning fuse. Flames shot 125 ft. into the air, and the berg was so badly cracked that one-third of it broke away completely a few hours later.

This experiment was quite promising, and Professor Barnes subsequently tried thermit on bigger icebergs, with such success that he hopes eventually to be able to destroy all the bergs that are a menace to shipping in the North Atlantic ocean during a portion of each year. He thinks that very little thermit is necessary if it is ignited in several deep holes bored at different parts of the iceberg.

In order to speed up the work of destruction, and also to avoid the necessity for landing on a berg, Professor Barnes is now trying to devise a "thermit bomb" that will melt its way into the ice when thrown on a berg. A slow-burning fuse would ignite the charge when the bomb had sunk to a sufficient depth.

The Speed of Birds

During the attempt on the world's speed record recently made by Lieut. D'Arcy Greig, onlookers remarked that the usually unperturbed sea-gulls fled in terror on the approach of his machine. This is not surprising, for its speed was more than 100 miles per hour greater than that of the swiftest birds.

Now that man has taken to the air we can make better estimates of the velocities of birds. The speediest are swallows and swifts, which often attain 200 miles per hour. Other birds that in the past have had a reputation for great speed are wild duck and geese. Careful observation has shown that express trains have little difficulty in keeping pace with them, however, thus proving that their speed limit is below 100 miles per hour. Small perching birds such as the cuckoo, the thrush, and the blackbird are slowest of all. They fly at speeds varying from 10 to 30 miles per hour, and a crack sprinter would give most of them a good race over a course of 100 yards.

Occasionally more exact measurements of the speeds of birds have been made. An airman in Mesopotamia, for instance, once noticed a vulture ahead of his machine, and gave chase. He increased his speed as the vulture fled before him, and finally caught it at 110 miles per hour. This is not recognised as an "official" world's record, however; the holder of this is a swallow who built her nest under the eaves of a house in Antwerp. She was taken to a town 148 miles away, and released in the company of a number of pigeons. One hour and eight minutes later the swallow was back on her nest, after covering the distance at an average speed of almost 135 miles per pour. The first pigeon did not arrive until two hours later!

* * * *

If the South Pole should Thaw!

It has been calculated that the complete melting of the Antarctic ice cap would release sufficient water to raise the level of the oceans by 50 ft. Fortunately there is very little prospect of this occurring suddenly, and even if the ice cap is at present melting, as some scientists believe, the rise in the level of the sea will be so gradual that we need not fear a world-wide catastrophe.

A slow rise in the level of the oceans eventually might cause serious floods in districts slightly above sea level, however. It has been suggested that the universal tradition of a great flood in prehistoric times may have its origin in a similar rise that occurred in the level of the oceans at the end of the last Ice Age. This great thaw came about 20,000 years ago, and the melting of the ice would undoubtedly cause a great increase in the bulk of water in the seas.

Famous Aero Engines

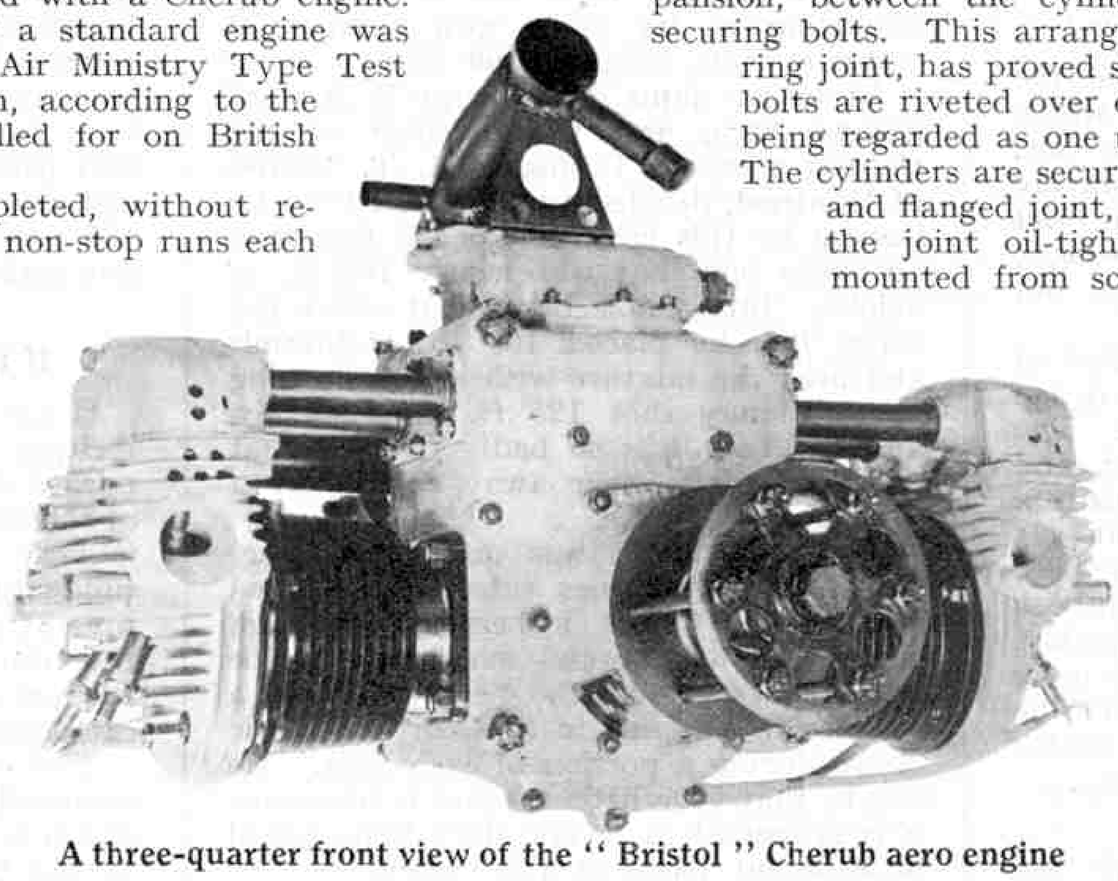
VIII.—The "Bristol" Cherub, Series III

The Cherub-engined "Bristol" Brownie. For this and the other photographs illustrating this article we are indebted to the Bristol Aeroplane Co. Ltd., of Filton, Bristol

THE rapid development of light aeroplanes has resulted in a demand for engines of suitable power, which should combine lightness with absolute reliability. Of these engines one of the best known is the "Bristol" Cherub. This engine achieved a remarkable success in 1925, when in British Air Ministry competitions held at Lympne, six of the seven events flown were won by aircraft equipped with Cherubs. Later in the same year, again at Lympne, the Cherub maintained the record it had set up, for in the six races included in the programme five first prizes were won by Cherub-engined aeroplanes, which also secured the first five places in the race for the Grosvenor Cup. Cherub-engined aircraft also took three out of four first prizes in competitions for altitude, and for speed over a measured course. At New York in October, 1925, every first prize offered for light aircraft was taken by the Powell Racer, which was the only machine taking part that was fitted with a Cherub engine.

In December of the same year a standard engine was submitted to the hundred hours Air Ministry Type Test run under Air Ministry supervision, according to the latest schedule similar to that called for on British standard service aero engines.

This test was successfully completed, without replacement or dismantlement, in 10 non-stop runs each of 10 hours' duration, at normal r.p.m., together with the usual high speed and high power tests. The average power developed at normal r.p.m. on the final five minutes of each 10 hour non-stop run was 34 b.h.p. The average fuel consumption for the whole of the 100 hours was 1.92 gallons per hour, and the oil consumption only .68 pints per hour, these results being slightly below the rated consumption at normal r.p.m. which is two gallons per hour and one pint per hour for fuel and oil respectively. The power developed by the engine improved throughout the run. On the final power curve that was taken at the completion of the test the engine developed 34.5 b.h.p. when running at a speed of 2,900 r.p.m., and 36.0 b.h.p. at 3,200 r.p.m.



A three-quarter front view of the "Bristol" Cherub aero engine

At the conclusion of the test the engine was stripped for examination, and, in the words of the official report, "the condition of the engine was excellent."

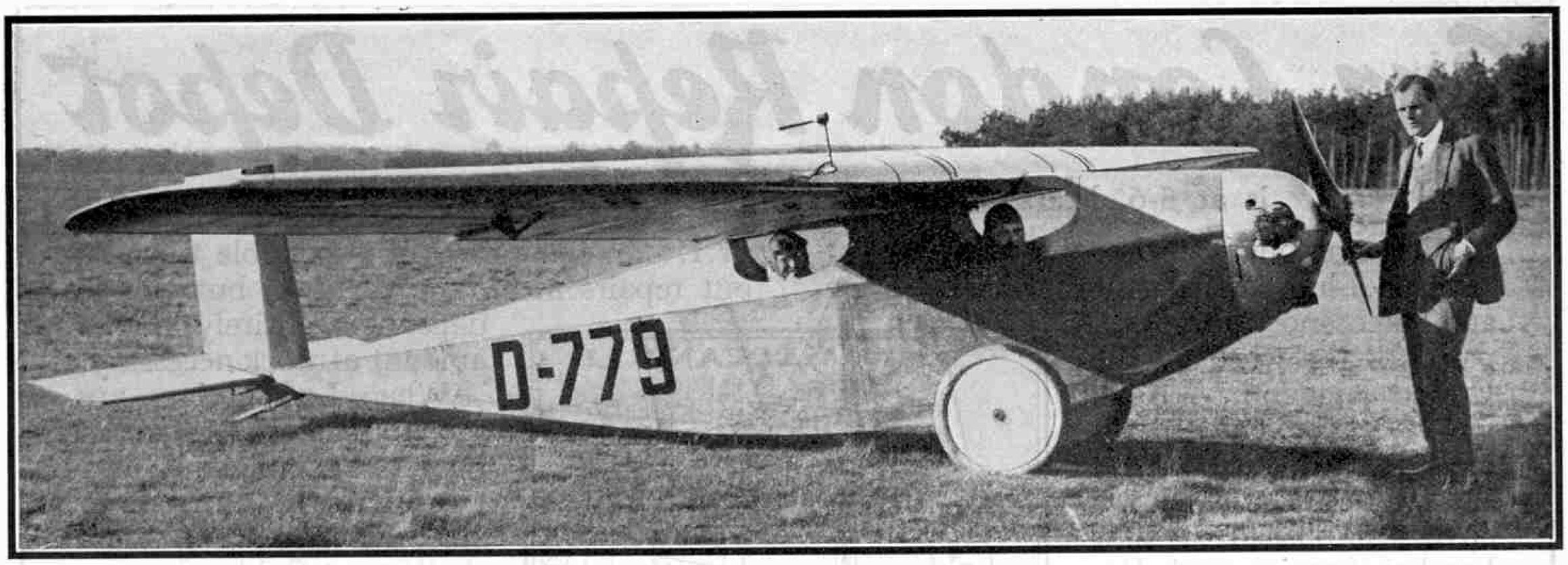
The "Bristol" Cherub Series III engine is of the air-cooled horizontally opposed twin-cylinder type, with a dry weight of only 100 lb., and possessing a normal power of 32 b.h.p. at 2,900 r.p.m. and a maximum of 36 b.h.p. at 3,200 r.p.m. The two cylinders, with a bore of 3.54 in. by 3.80 in., have steel barrels, but the inlet and exhaust passages are formed in the aluminium alloy heads, which also carry the screwed-in alloy steel valve seats, valve guides, valves and springs. A deep spigot for the head is provided on the barrel with a flange to which the head is bolted. The spigot protects the vital joint, which is formed by a copper ring spigotted and very carefully fitted in annular grooves cut in the head and barrel flanges.

As the rates of expansion of aluminium and steel are different, great difficulty is usually encountered in the maintenance of a really gas-tight joint with this type of head. In the Cherub heads this difficulty has been entirely overcome by inserting packing pieces of a special alloy, having an unusually low rate of expansion, between the cylinder heads and the heads of the securing bolts. This arrangement, combined with the copper ring joint, has proved so satisfactory that the ends of the bolts are riveted over on their nuts, the head and barrel being regarded as one unit that need never be disturbed. The cylinders are secured to the crankcase by a spigotted and flanged joint, a Dermatine ring serving to make the joint oil-tight; while the complete engine is mounted from screwed extensions on the ends of the four crankcase bolts at each corner of the crankcase. A standard connection for a tachometer is arranged on the port side above the magneto.

The pistons give a stroke of 90 m.m. by 96 m.m. and are of aluminium alloy. They are fitted with three rings, the lower one of which serves as a scraper and returns surplus oil from the cylinder walls through drain holes in the piston skirt. The hollow gudgeon pins float both in the piston bosses and in the connecting rod small ends, and are located endways by bronze buttons pressed into their open ends.

The inlet and exhaust valves are of cobalt-chrome steel and are interchangeable, while three concentric springs are used on each valve. The valve operating gear is somewhat unusual and possesses distinctive features of considerable importance.

The camshaft, which with its four cams is machined from the solid, runs across the crankcase below the crankshaft and is driven by plain spur gears of ample dimensions. The cams are of the



The Messerschmitt monoplane, fitted with a Cherub engine, which obtained first prizes both for speed and altitude at an International flying meeting held at Munich in 1925

constant acceleration type. The valves are operated by rocker shafts, which run parallel to the cylinder axes from crankcase to cylinder head. These may be regarded as the precise equivalent of the normal type of rocker arm that is interposed between camshaft and valve in the overhead camshaft type of engine, with the single difference that a rocker that is operated through a finger, by the cams, is separated from that which operates the valves by a length of shafting.

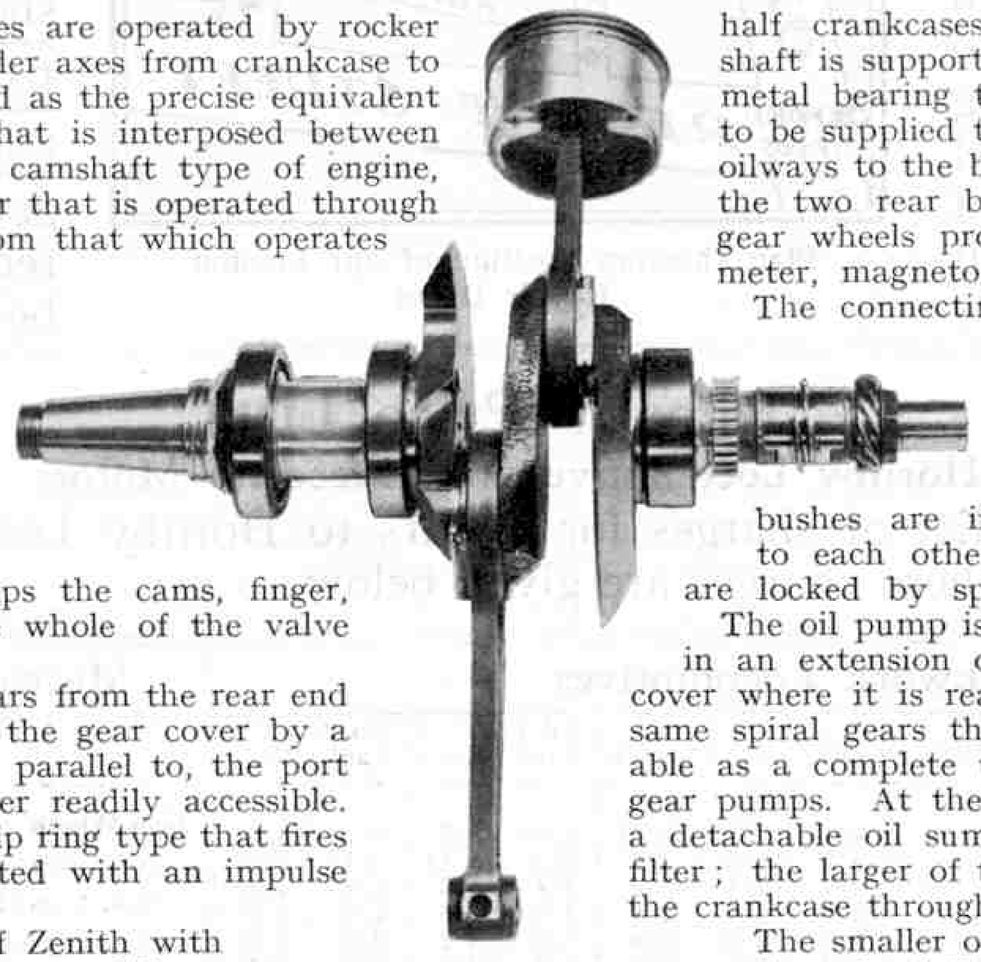
As the valve stems project from the cylinder heads radially relative to the cylinder bore, any difference between the expansion of the cylinder and that of the rocker shaft merely moves the valve stem slightly across the face of the operating rocker, but does not alter the valve clearance. A torsion spring fitted to the rocker shaft keeps the cams, finger, and operated rocker in contact. The whole of the valve gear is entirely enclosed.

The magneto is driven by spiral gears from the rear end of the crankshaft. It is mounted on the gear cover by a flange and spigot and lies behind, and parallel to, the port side cylinder, with the contact breaker readily accessible. The magneto is a double pole double slip ring type that fires two plugs in each cylinder. It is fitted with an impulse starter to render starting easy.

The carburetter is a special type of Zenith with hand operated altitude control of the extra diffuser air type, and is bolted to a cast aluminium induction T piece attached by studs and nuts to a broad facing on the under-side of the magneto and pump housing on the rear cover. The throttle and magneto advance and retard are interconnected by a suitable arrangement of levers and links. The altitude control is independent, except that it is closed automatically when the throttle is closed. The air intake to the carburetter is an exhaust jacketted steel elbow. The induction pipes run from the T piece parallel to the cylinders, and are fitted into it with airtight expansion joints. They are provided with bosses to take primer jets.

The crankshaft is a case hardened alloy steel stamping of ample dimensions, carried in four bearings, while the crankcase is an aluminium casting split vertically on the engine centre line and provided with separate front and rear covers.

There are three main journal bearings. The front one is of the deep grooved type, located in the nose of the conical front cover, and transmits the propeller thrust from the crankshaft to the case. The other two are of the double row self aligning type. They are situated adjacent to the crank throws, one in front and the other behind, and are housed in the front and rear half crankcases respectively. The tail end of the shaft is supported in the rear cover by a plain white metal bearing that provides an oil seal, allowing oil to be supplied through the hollow tail end and drilled oilways to the big end bearing. On the shaft between the two rear bearings a spur wheel and two spiral gear wheels provide drives for the camshaft tachometer, magneto and oil pump respectively.



A view of the crankshaft and connecting rod assembly

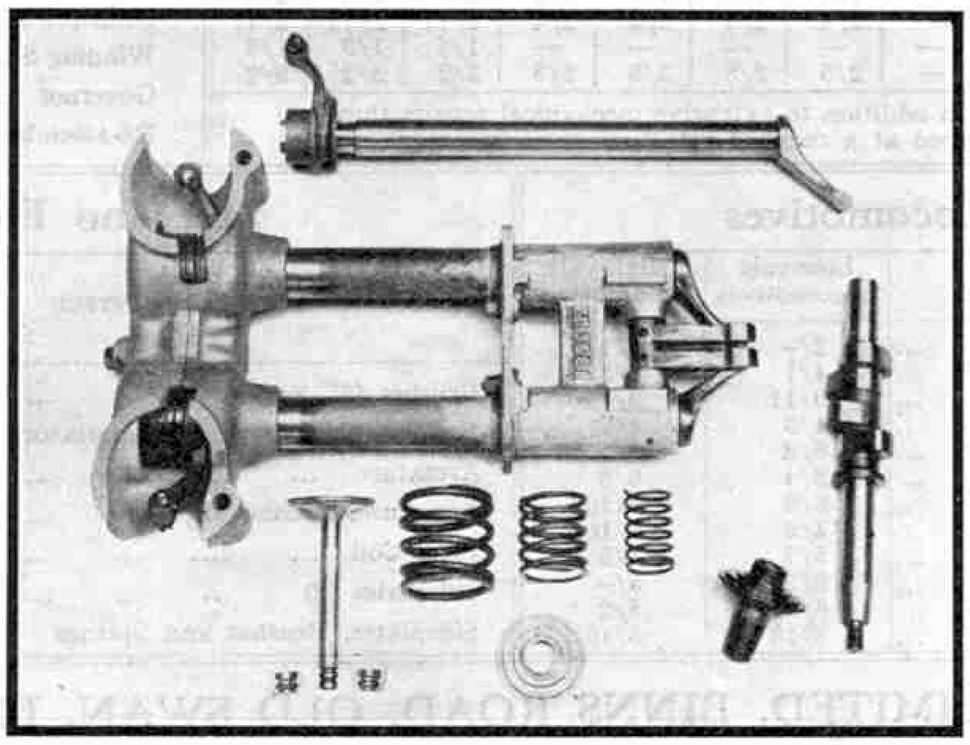
The connecting rods are alloy steel forgings with hardened liners pressed into the big ends, the proportions of which are such that the rods may be threaded over the shafts. When in position, the split bronze floating bushes are inserted and the two halves secured to each other by high tensile steel screws which are locked by split pins.

The oil pump is located behind the starboard cylinder in an extension of the magneto housing and the rear cover where it is readily accessible, and is driven by the same spiral gears that drive the magneto. It is detachable as a complete unit and consists of two independent gear pumps. At the bottom of the crankcase is provided a detachable oil sump containing an easily removable oil filter; the larger of the two pumps draws oil drained from the crankcase through this filter and returns it to the tank. The smaller or feed pump supplies it under pressure through drilled oilways to the big end bearings and the bush bearings of the crankshaft and intermediate wheel. This pump is provided with a spring loaded pressure adjuster, the bye-passed oil being returned to the suction side of the pump.

The spiral gears are adequately lubricated by oil collected in a well into which the lower gear dips. The bearings of this gear are automatically lubricated by the oil which flows from a similar but smaller well, special provision being made to prevent leakage through this bearing into the magneto housing.

When the engine is fitted in an aeroplane it is necessary for the oil to be supplied from a separate oil tank, large enough to allow for two pints for circulation purposes, plus two pints for each hour's duration of flight, the duration being based upon the petrol tank capacity. The tank should be installed so as to give a slight positive head.

The propeller used with the "Bristol" Cherub engine can be a two-bladed one of either the wooden or Reed duralumin type, but it is desirable that it should be of a sufficient weight to provide a flywheel effect, and it is essential that it is in proper balance. The actual diameter and pitch will naturally depend upon the machine and its normal operating conditions and performances.

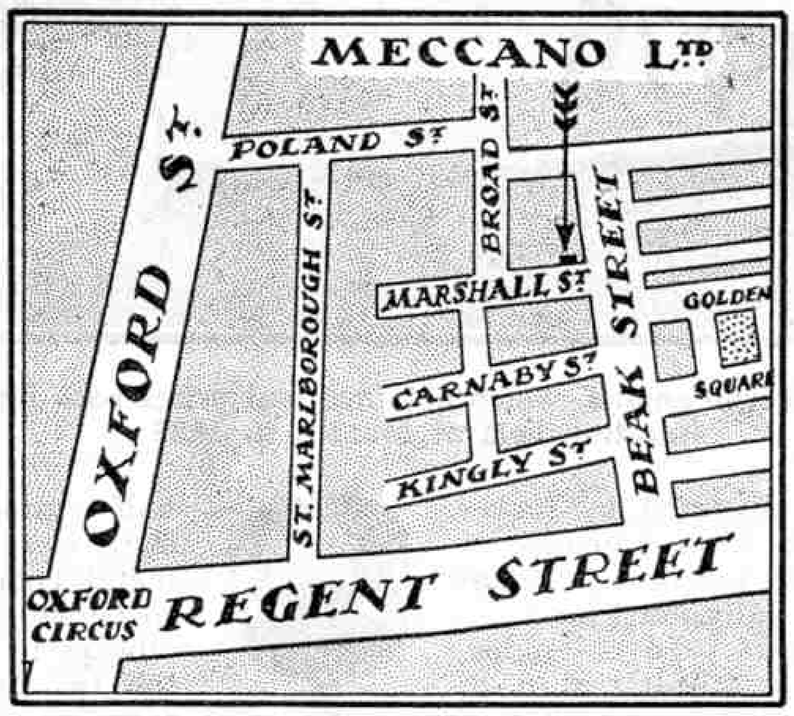


The valves and rocker gear of the "Bristol" Cherub

Our London Repair Depot

is at 5-6, Marshall Street, Golden Square, London, W.1

Hitherto our Service Department at Liverpool has carried out all Hornby Train and Meccano Motor repairs for the whole of the United Kingdom. Now, for the convenience of boys living in London and the Home Counties, we have established a new London Service and Repair depot, fully equipped to deal expeditiously with all Hornby and Meccano repairs. The accompanying map shows how to find the depot, the address of which is 5-6, Marshall Street, Golden Square, W.1. In some cases it is possible to carry out repairs in an hour or two, but this is dependent entirely on the amount of work necessary.



Plan showing Position of our London Repair Depot

When Locomotives are sent to the depot by parcel post they should be packed carefully and addressed to Meccano Ltd., 5-6, Marshall Street, Golden Square, London, W.1. A note should be enclosed in the parcel giving the name and address of the sender, together with full instructions regarding the repairs to be carried out.

Repairs Price List

Hornby Locomotives and Meccano Motors

We have compiled a list of charges for repairs to Hornby Locomotives and Meccano Motors. Particulars of these charges are given below.

Hornby Clockwork Locomotives

New Parts Fitted, and Renovations	M1/2	M3	No. 0	No. 1	No. 1 Tank	No. 2	No. 2 Tank	No. 3
Gear Wheels								
No. 1 Gear Wheel	—	2/11	2/11	2/11	2/11	3/7	3/7	3/7
Nos. 1 and 2 Gear Wheels	—	3/2	3/2	3/2	3/2	3/11	3/11	4/–
Nos. 1, 2 and 3 Gear Wheels	—	3/4	3/4	3/4	3/4	4/3	4/3	4/4
Nos. 1, 2, 3 and 4 Gear Wheels	—	3/6	3/6	3/6	3/6	4/6	4/6	4/7
No. 2 Gear Wheel	—	2/6	2/6	2/6	2/6	3/2	3/2	3/3
Nos. 2 and 3 Gear Wheels	—	2/8	2/8	2/8	2/8	3/6	3/6	3/7
Nos. 2, 3 and 4 Gear Wheels	—	2/10	2/10	2/10	2/10	3/9	3/9	3/10
No. 2 Gear and Reversing Pinion	—	2/8	2/8	2/8	2/8	3/4	3/4	3/5
No. 3 Gear Wheel	—	2/5	2/5	2/5	2/5	3/2	3/2	3/2
Nos. 3 and 4 Gear Wheels	—	2/7	2/7	2/7	2/7	3/5	3/5	3/5
Housings								
*New Housings	1/9	2/6	3/6	4/–	4/–	6/6	7/–	11/–
Enamelling Housings	—	—	3/1	3/4	3/4	5/–	5/8	7/4
Additional charges for enamelling Housings in cases where repairs are also effected	—	—	1/10	2/1	2/1	3/8	4/4	6/–
Miscellaneous								
Mainspring	–/11	1/7	1/7	1/7	1/7	1/10	1/10	2/–
Set of Motor Wheels	—	1/8	1/8	1/8	1/8	2/3	2/3	2/3
Winding Shaft	—	2/4	2/4	2/4	2/4	2/11	2/11	2/11
4 Bogie Wheels	—	—	—	—	—	1/5	1/5	1/5
Governor	—	2/5	2/5	2/5	2/5	3/2	3/2	3/2

*In cases where new housings are fitted in addition to extensive mechanical repairs they will be charged at a reduced rate.

Meccano Clockwork Motor

New Parts Fitted	Clockwork Motor
Gear Wheels	
No. 1 Gear Wheel	1/10
Nos. 1 and 2 Gear Wheels	2/–
Nos. 1, 2 and 3 Gear Wheels	2/2
Nos. 1, 2, 3 and 4 Gear Wheels	2/4
No. 2 Gear Wheel	1/3
Nos. 2 and 3 Gear Wheels	1/5
Nos. 2, 3 and 4 Gear Wheels	1/7
No. 2 Gear and Reversing Pinion	1/4
No. 3 Gear Wheel	1/3
Nos. 3 and 4 Gear Wheels	1/5
Miscellaneous	
Mainspring	1/7
Winding Shaft	1/2
Governor	1/5
Re-assembling only	1/–

Hornby Electric Locomotives

New Parts Fitted	Low-volt Locomotives	High-volt Locomotives
Brushes (2), Springs (2)	2/–	1/11
Brushes, Springs and Commutator	4/1	4/5
Brushes, Springs and Shoes	3/11	3/10
Brushes, Springs, Shoes and Commutator	4/3	4/7
Armature	5/8	6/1
Armature, Brushes, Springs	6/4	6/8
Armature, Brushes, Springs, Shoes	6/6	6/10
Field Coil	4/6	4/10
Sideplates (2)	5/7	4/5
Sideplates, Brushes and Springs	6/3	5/–
Sideplates, Brushes, Springs and Shoes	6/5	5/2
Collector Shoe Complete	3/10	3/10

Meccano Electric Motors

New Parts Fitted	Low-volt Motor No. 1	High-volt Electric Motor No. 2
Brushes (2), Springs (2)	1/9	1/9
Brushes, Springs and Commutator	3/3	3/7
Armature	3/7	6/11
Armature, Brushes, Springs	4/2	7/6
Field Coil	3/5	3/9
Sideplates (2)	2/8	2/8
Sideplates, Brushes and Springs	3/3	3/3

MECCANO LIMITED, BINNS ROAD, OLD SWAN, LIVERPOOL

Instruments of the Air

How the Pilot Navigates His 'Plane

By "Airman"

IT is quite possible for the pilot of an aeroplane to fly accurately from one place to another without referring to any instruments at all. On a clear day, when the surrounding country can be seen for miles around, the obvious thing for the airman to do is to keep the nose of the machine pointing towards the destination he has in sight, and leave the instruments to take care of themselves.

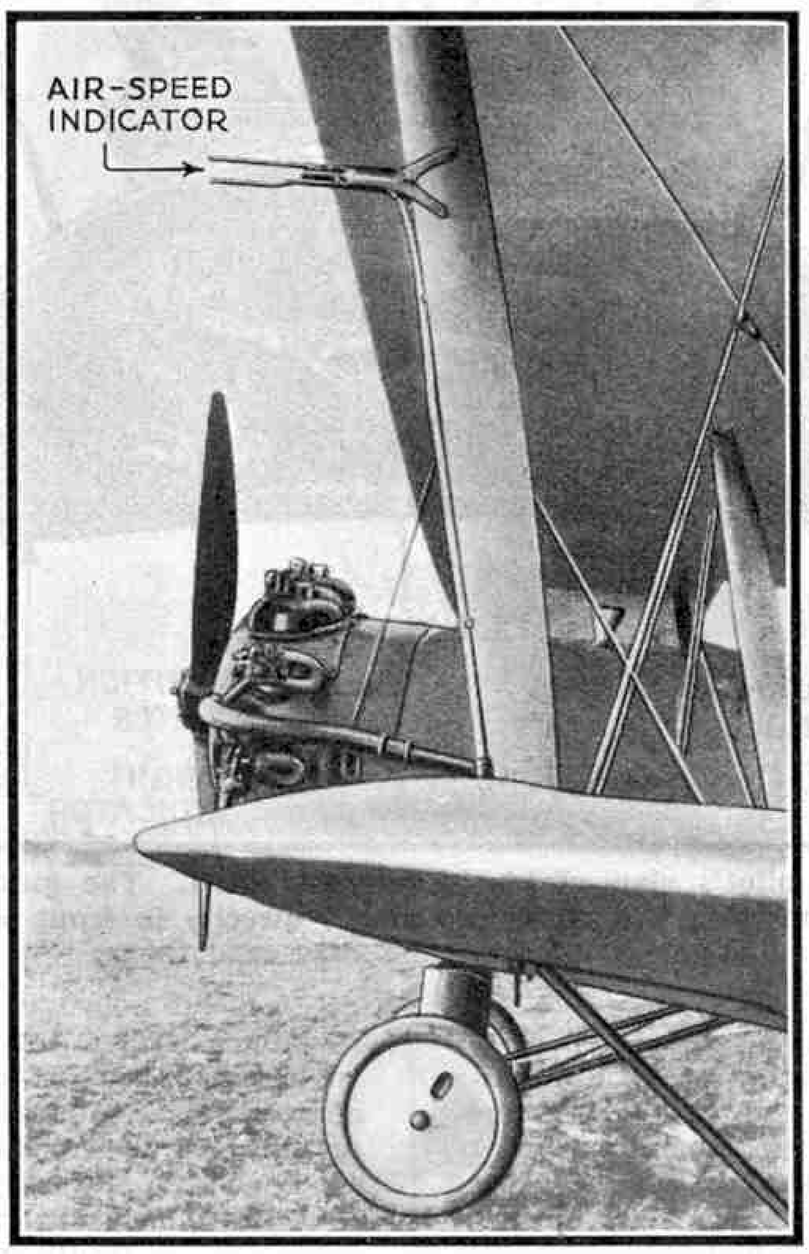
This method cannot always be followed, however. When flying in the clouds, for instance, the airman may find his machine behaving in a most erratic manner, and he has only his instruments to tell him his position relative to the earth. On cross-country flights the pilot needs a map to guide him, and he possesses an even more valuable adjunct in his compass. If he has calculated his course correctly before setting out, and if he allows for such known factors as the speed of his machine over the ground, it is possible for him to arrive at a given destination without the use of even a map.

All aeroplanes now carry instruments of various descriptions, and these form a most important part of flying equipment.

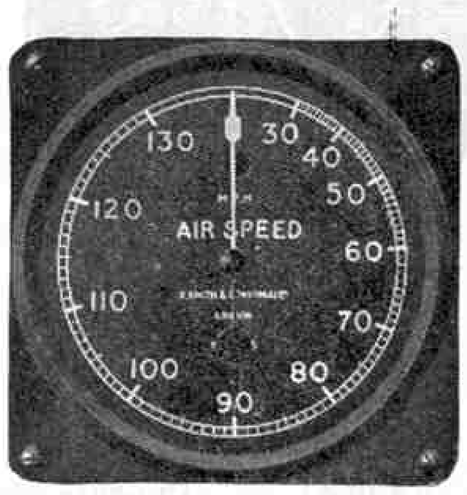
The instruments usually found on the dashboard of an aeroplane are:—(1) THE COMPASS, to show the direction of flight; (2) THE CLINOMETER, showing lateral stability, that is showing whether the machine is flying with one wing down; (3) THE ANEROID BAROMETER or HEIGHT INDICATOR, which indicates the height of the machine *above its original level*; (4) THE AIR-SPEED INDICATOR, indicating the speed at which the machine is travelling through the air; (5) THE ENGINE REVOLUTION COUNTER, showing the number of revolutions of the engine; (6) THE TRANSMITTING THERMOMETER, showing the temperature of the water and the oil; (7) PRESSURE GAUGES, air and oil.

Other instruments are in use but generally for special purposes only.

The instruments are as far as possible grouped together on the dashboard, so that they can be seen easily at a glance by the pilot.



How the pressure head of the air-speed indicator is mounted to be clear of the propeller stream



This dial shows air speed in miles per hour

The magnetic compass holds a most important place among the instruments of the air, as it is the only one that can tell the pilot the direction in which he is flying. It is placed in the fore-and-aft line of the machine when the latter is in the flying or level position, and it should be perfectly level, both fore-and-aft and laterally, with the machine in that position.

The compass card is circular and is divided into 360 degrees, read in a clockwise direction. It is pivoted so that it is free to rotate in the horizontal plane, and in order to avoid the effects of vibration it is immersed in a liquid that is a mixture of distilled water and alcohol. The liquid is contained in a bowl fitted with a glass window so that the card may be observed. On the outside of the bowl and in the fore-and-aft line of the aeroplane is a mark termed the "lubber's line," and this line registers the change of direction on the card, since the latter is pivoted and remains stationary when the machine is turning.

Another and more modern type is the vertical compass. The compass card in this type is a circular and vertical band attached to the rim of a flat pivoted float. The needle is carried inside the float. The "lubber's line" is at the back of the instrument and the compass is read from the back, the final "0" in the figures being omitted, so that when the compass reads, for example, 26 against the lubber's line, the bearing is 260 degrees.

The red end of the compass needle points to magnetic north and the other end to magnetic south. Magnetic north, however, is not the same as true north. Owing to the fact that the magnetic and geographical poles do not coincide, the needle is deflected from true north, the amount of deflection being called variation. Variation at any point alters by a slight amount every year. At Greenwich it is about 15 degrees West, so that the magnetic compass at Greenwich points to 15 degrees West of North.

The needle also may be deflected by magnetic material carried in the aeroplane. The angle between the compass North-South and the magnetic North-South is called deviation and the total error caused by compass deviation and variation is called the compass error. Compasses are "swung" to test their accuracy in the manner described in the article "Swinging a Compass," on page 963 of the November, 1927, *"M.M."* A deviation table is prepared and pinned up in the machine after a compass has been "swung."

Before starting on a cross-country flight the airman calculates his compass course with the aid of his knowledge of navigation. Finding his true course from the map, he determines his magnetic course by adding or subtracting variation, and allows for deviation to find his compass course. Then, knowing the direction and velocity of the wind and the air speed of the machine, he can find the direction in which to steer in order to arrive at his destination.

The clinometer is a curved tube filled with alcohol and water, this mixture being used to prevent the freezing of the liquid. It is designed to indicate cross level, a bubble in the liquid remaining in the centre of the tube—which is graduated to show angles of 20 degrees on each side—when the machine is flying laterally level. If the left-hand wing were to drop, the bubble would move to the right, and vice versa. If a turn is executed accurately, however, the bubble remains stationary, for the banking effect is sufficient to balance the centrifugal force. The airman can tell if he is making a turn correctly by watching the clinometer. If, for example, the bubble moves to the outside on a turn, he knows his bank is too great and he then decreases the bank or uses more rudder.

As a matter of fact the clinometer, which is also called a sideslip indicator, is very little used, for the pilot learns to fly accurately by touch and sight and too close attention to his instruments tends to confuse him. In normal circumstances he can tell instinctively whether he is executing a turn correctly. The clinometer is most useful for reminding a pupil that he is not flying level, and that one or the other of the wings of his machine is too low.

The aneroid barometer, altimeter or height indicator is operated by the pressure of the air. The air is exhausted from a corrugated round metal box to the centre of which is fastened a spring. At sea level, atmospheric pressure bears upon the sides of the box with a pressure of 14.75 lb. per square inch, and the spring pulls against this pressure. Air pressure diminishes with height at the rate of approximately ½ lb. per sq. in. per 1,000 ft. of ascent, and as the aeroplane climbs the box expands. By a system of levers the expansion or contraction of the box is conveyed to a pointer that moves over the dial of the instrument. This is calibrated to show at any moment the height in hundreds and thousands of feet.

The dial is always set to register zero at the aerodrome of the machine, for the height of different aerodromes above sea level varies.. The dial can be made to rotate so that changes due to atmospheric conditions may also be compensated for.

The reading of the height indicator is only approximately correct under certain conditions. In landing, for instance, machines descend at such a speed that the mechanism of the instrument has no time to adjust itself to the altered conditions and in consequence the instrument falls behind, or "lags."

The speed of an aeroplane is registered by its air-speed indicator. This instrument only measures the rate at which the machine travels through the air. If a 10 mile-an-hour wind is blowing against an aeroplane in flight, its speed over the ground is diminished by a corresponding amount.

The air-speed indicator may be said to consist of three parts—the pressure head, the aluminium tubing and the indicator itself. The pressure or Pitot head consists of two tubes fitted to the outer interplane strut so as to be clear of any propeller slipstream effect. They point straight ahead, and are arranged parallel to one another, as shown in the accompanying photograph.

The end of the straight tube is closed and is carefully streamlined. The lower tube is open and thus the stream of air is free to enter it. The difference between the pressures in the tubes is a measure of the air speed and is passed on through aluminium tubing to an indicator mounted on the pilot's instrument board.

The indicator is a box divided into two compartments by a diaphragm made of rubber or thin sheet metal. The greater pressure in the compartment connected to the open tube causes the diaphragm to bend and the movement is conveyed by means of a silk thread to a pointer moving over a scale. The dial of the instrument is graduated to read in tens of miles per hour, the lowest reading being usually 40 miles per hour and the highest 160.

The air-speed indicator is subject to pronounced faults, and care must be taken to note the conditions of flight if an idea of the correctness of a reading is to be obtained.

In the first place, the tubes of the pressure head must be pointing in exactly the opposite direction to the air stream with the machine in level position. Otherwise a false reading will be made. Secondly, the air pressure inlet and the small holes in the static tube must be free from dirt, oil and grease. Air leakages would make the instrument inaccurate. Sound rubber joints are thus necessary and they are secured by copper wire. The pressure tubes must, of course, be connected correctly to their respective compartments.

The effect of altitude on the instrument is to cause the indicator to give low readings, the amount of decrease being approximately 1.5 per cent. per 1,000 ft. This is due to the decrease of atmospheric pressure with height, and in order to obtain a true reading a correction must be made. With the air speed indicator, as with the height indicator, there is a considerable "lag" in the action of the instrument.

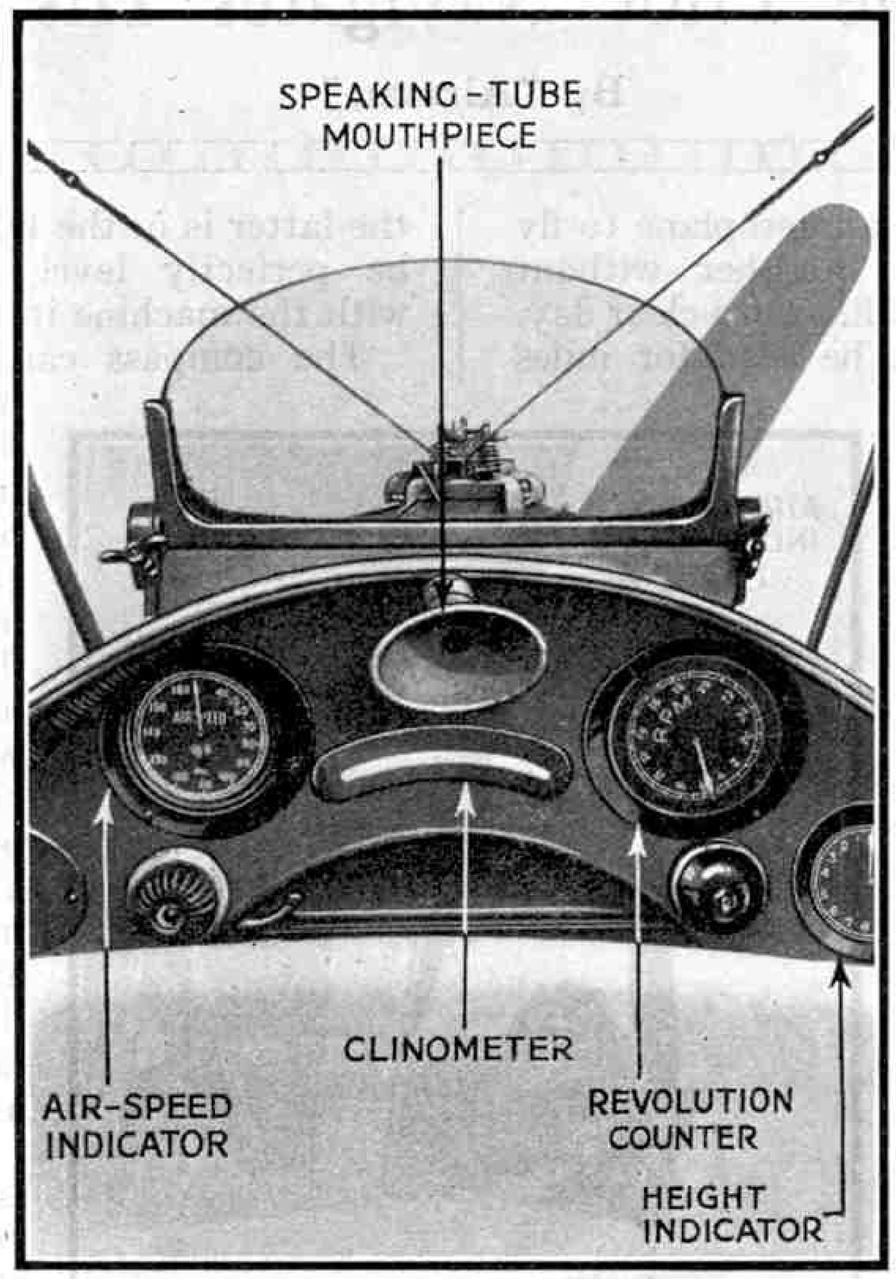
The engine revolution counter is driven off the crankshaft, the camshaft, or the pump spindle. Its dial reads in revolutions per minute. Most of the revolution counters in use work on the principle of centrifugal force, a flyweight being hinged to a governor weight that swings outward and tends to assume a position at right-angles to the shaft as the engine rotates. This movement is conveyed to a pointer by means of a system of levers, the revolution being conveyed to the indicator by a flexible drive. In order that wear and tear on the drive may be reduced, it is geared down to one-quarter engine speed through a gearbox, further gearing in the indicator increasing the speed to engine speed so that the dial may read correctly.

Occasional lubrication is necessary, but excessive oiling may result in the entrance of oil into the instrument through the flexible drive. This may put the instrument out of action by causing the pointer to stick.

The transmitting thermometer, a necessary fitting to all water-cooled engines, is used to show the temperature of the water. It consists essentially of a container and a length of steel tubing, which are filled with liquid ether. The container is fitted into the radiator. When the temperature of the water becomes such as to cause the ether to boil, a pressure due to the vaporisation of the ether is developed. This is registered on a gauge marked in degrees Centigrade. Ether is used because of its very low boiling point.

The effect of atmospheric pressure on the boiling point of water must be considered when the thermometer is used. Approximately this falls 1°C. for every 1,000 ft. of ascent, and at great altitudes the water in the radiator may be nearer boiling point than the thermometer reading suggests.

Aircraft pressure gauges are constructed on the principle that if a curved tube is subjected to internal pressure it tends to straighten out. The Bourdon Pressure Gauge consists of a phosphor-bronze tube bent to the shape of part of a circle. One end of the tube is sealed while the other is open and connected by copper tubing to the source of the pressure. The air from the latter enters the tube and tends to straighten it out to an extent proportionate to the pressure. The movement is conveyed to a pointer by means of a connecting arm, spring and toothed quadrant. The last named engages with a pinion on the pointer spindle, the pointer moving over a dial



A pilot's view of his instrument board. The most important indicators are placed directly in front of him in order that he may read them

Revolution counter reading up to 2,600 r.p.m.

that is graduated directly in pounds per square inch.

A gauge for showing the amount of petrol in a tank consists in its simplest form of an ordinary glass tube. This should be fitted with a tap so that in the event of a breakage the flow of petrol may be shut off. The quantity of petrol in the tube is registered accurately only when the machine is flying level. A gauge fitted at the back of the tank will indicate more than the correct quantity when the machine is climbing and less when it is descending, owing to the effect of gravity on the liquid in the tank.

There are other instruments used on aircraft, particularly in Service machines and machines of advanced type, but the above are those usually found on all types.

A voltmeter and an ammeter are carried, but these need no description. The turn indicator is an instrument for indicating the direction of a turn when the aeroplane is flying amidst clouds, as in such circumstances it is very difficult to determine the direction of the machine. A barograph is a recording barometer used to show the course of a machine graphically. From the chart such information as the rate of climb or glide and whether the climb or glide has been regular may be deduced. The watch and map carrier, although these can hardly be described as instruments, are of course of great importance to the airman. The fore-and-aft level is what its name implies, but the air-speed indicator is more reliable as a means of telling the airman whether he is keeping his correct flying position.

Very often a pilot can make use of one instrument as a check upon another, or he may use a combination of two when another has failed. For example, the compass card itself can tell him that the machine is not flying level if it dips or rises, whether fore-and-aft or laterally. If the card begins to spin in a cloud, it is a sign that the aeroplane is turning, since the card remains stationary and merely appears to turn. If the pilot is turning correctly in a cloud he has no indication, if he does not consult his instruments, that he is turning at all.

A pilot can tell whether his engine is giving its full power by keeping his machine at its normal flying speed and watching the height indicator for a drop. If the nose of the machine goes down, it is a sign that the engine is not giving its full power.

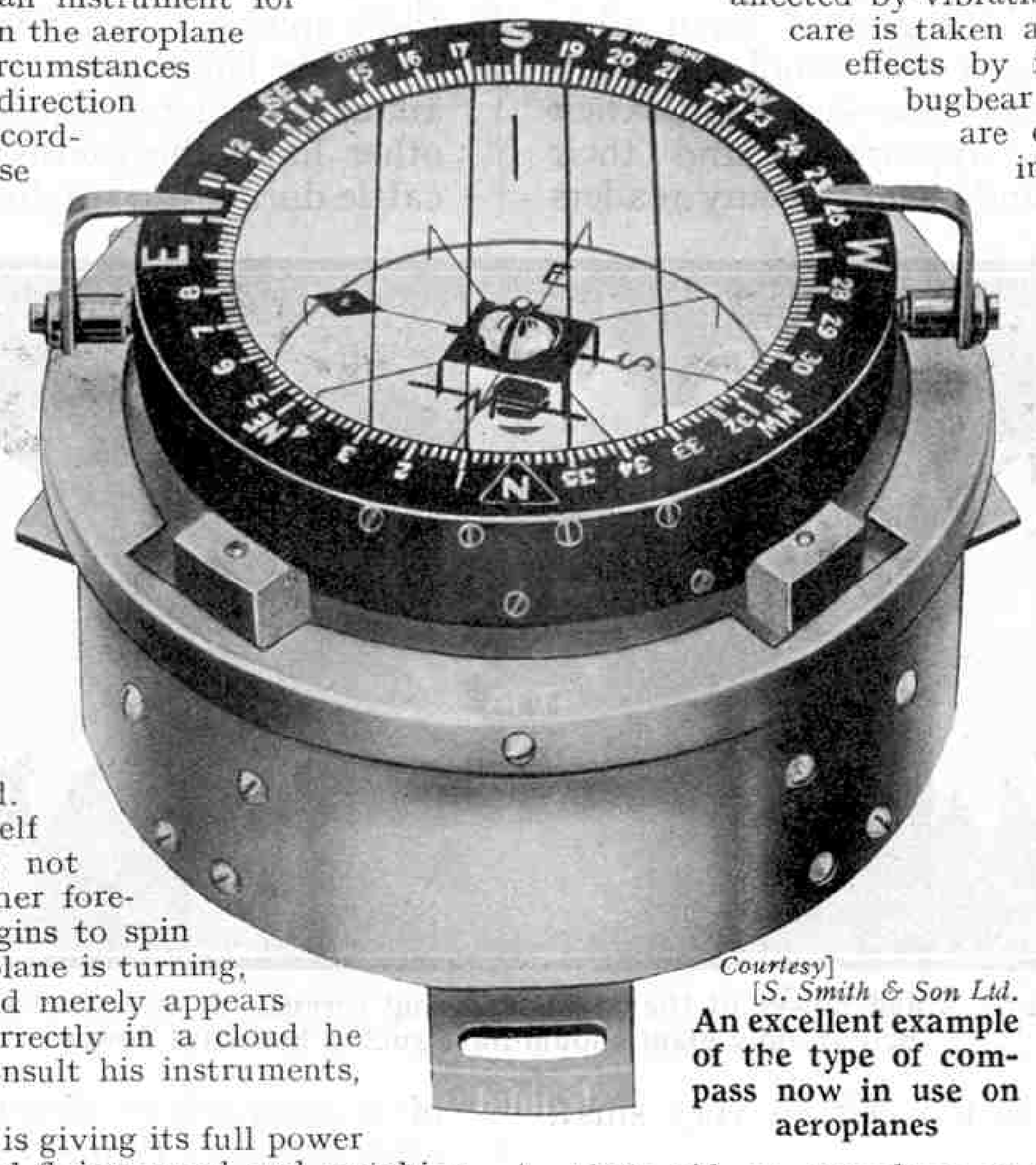
The air-speed indicator may tell the pilot whether he is climbing or descending, according as the air speed decreases or increases. Used with the aneroid, it can tell him how his engine is running.

Within narrow limits, the slowing down or increase in the number of revolutions of the engine, as shown by the revolution counter, may give the pilot a very useful indication whether the aeroplane is climbing or descending.

In addition to its ordinary uses, the watch may be used to indicate the direction of north and south. If the hour hand is pointed toward the Sun, the line dividing the angle between the Sun and the figure 12 on the watch is the North-and-South line, the South line of direction bisecting the acute angle.

From what has already been said it will be clear that the various instruments are subject to certain faults that may cause inaccurate readings to be made. The effect of atmospheric pressure, height and "lag" have been considered, and the condition of flight must always have an effect upon a reading. Compasses are affected by vibration and external magnetic effects, and care is taken as far as possible to eliminate these effects by insulation. Vibration is, indeed, a bugbear in flying as far as the instruments are concerned. Generally speaking, the instruments seldom get out of order, but are often inaccurate. When anything does go wrong the pilot does not tinker about with their internal mechanism but sends them to an expert for repair.

The compass, air speed indicator and aneroid are easily the most important instruments to the airman. As has been stated, however, the experienced pilot does not rely upon his instruments in the ordinary course of events for telling him whether he is flying correctly. If anything happens to his engine so that it does not run as it should, for example, he recognises a change by the sound of the engine. A pupil learns to fly by the "feel" of his machine, and he seldom refers to his instruments—which are, moreover, liable to mislead him. The airman finds them useful for checking the accuracy of his flying, but generally it is only when more than ordinary flying is done that he places his faith in these "instruments of the air." Without their aid an aeroplane could scarcely be navigated across the Atlantic Ocean or on long flights in polar regions. For such adventures special instruments are often used. Thus Lindbergh used an earth inductor during his flight from New York to Paris. He found this instrument more reliable than the ordinary magnetic compass, and gave it much of the credit for his success in keeping to the course he had planned. For ordinary flying it is unnecessary.



Courtesy [*S. Smith & Son Ltd.*

An excellent example of the type of compass now in use on aeroplanes

Measuring Light and Heat from the Stars

A daylight recorder so sensitive that it will accurately record light intensities to be found between starlight and direct sunlight, a range of more than a million foot candles or lumens, has been developed in the research laboratory of the General Electric Company of America by Dr. L. R. Koller.

This device consists of a giant photo-electric cell, 100 times more sensitive than the usual cell of this type, and a recording meter. The complete apparatus is operated by three dry cells and one small B battery is contained in a box but one foot square. Any variation in the intensity of daylight changes the flow of electrons or electric current within the cell, which in turn causes a variation in the movements of the recording needle in the meter. As this needle fluctuates, a roll of paper is slowly passed beneath the point, making a permanent record. The markings of the needle on this paper can be easily interpreted into light intensities either at the time or later by a chart prepared by Dr. Koller.

The photo-electric cell is a gas-filled bulb, 7 inches in diameter, coated on the inside with a very thin layer of caesium, a metal extremely sensitive to light. This layer of caesium must be just one atom deep.

"The head of an ordinary pin contains eight sextillion atoms and a cubic inch contains 200,000,000,000,000,000,000,000,000 atoms," Dr. Koller explained. "Perhaps this will give a better idea of the thinness of this coating of caesium. If it should be more than one atom deep, the tube would not operate as effectively."

We can all appreciate the fact that the stars send us light, but it is not quite so easy to realise that they also send us heat, although in such small quantities that the human body is utterly incapable of detecting it. Here again we have to call to our assistance an apparatus of extraordinary sensitiveness.

Experimental work in detecting and measuring the heat from the stars has been carried out for many years at the Mount Wilson Observatory in the United States. The method employed has been to concentrate the rays from a star by means of the great telescope of the observatory, and then to direct these rays upon a thermo-couple, that is the point of contact of two different alloys. The effect of heating such a junction is to set up an electric current, known as a thermo-electric current.

The alloys used are in the form of exceedingly thin wires and the current produced is extremely small, but quite sufficient to be detected by a special galvanometer. Some idea of the sensitiveness of the whole apparatus may be obtained from the fact that it has been found possible to measure radiation that heated the thermo-couple by less than one 100,000th part of a degree!

The possibilities of this method of measurement are very great. The stars have already been arranged in order of their light value, and the next step will be to arrange them in accordance with their heat radiation. The results already obtained in this direction are full of interest. The lustrous white star Sirius, for instance, the brightest star in the northern sky, does not radiate anything like so much heat as the red star Betelgeuse, which radiates more heat than any other star. It is clear that we shall have to revise our estimates of the comparative temperatures of the stars as based upon their colour and brilliance, for stars that are apparently of similar brightness vary to a very considerable extent in their powers of heat radiation.

Weird Plants of the Colorado Desert

A Living Water-Barrel

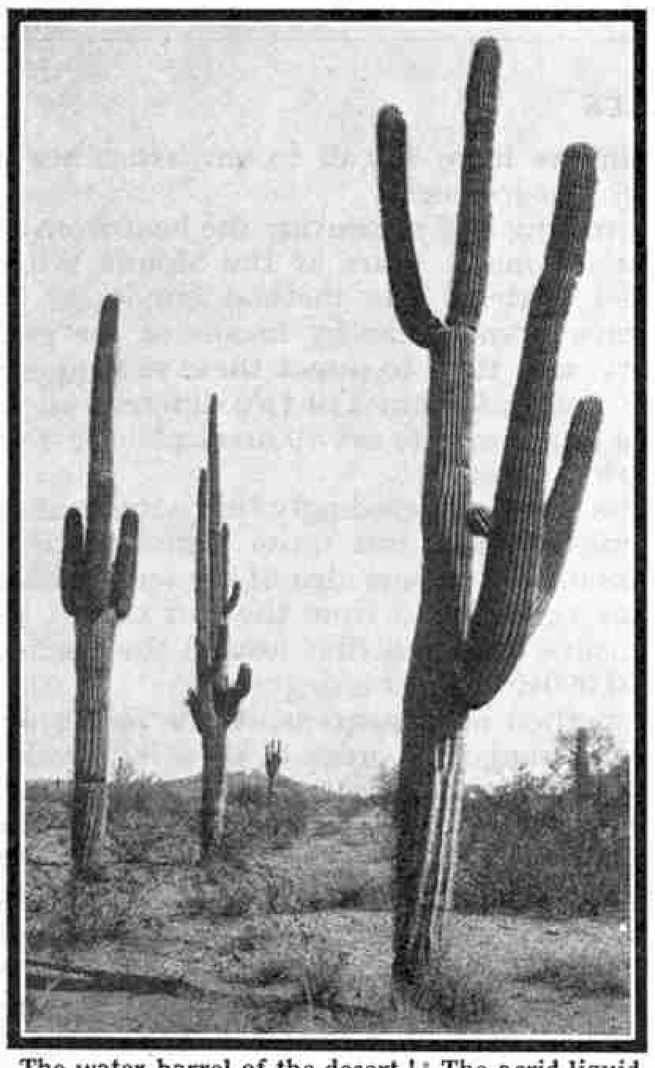
By H. J. Shepstone, F.R.G.S.

THE world contains a great variety of remarkable plants but probably the strangest of them all is the Cactus. Most of us have seen small specimens grown in hothouses and have remarked upon their peculiar and even grotesque appearance and their unlikeness to other plants around them. Many readers will be surprised, however, to know that some species of cactus attain the height of tall trees.

With few exceptions the cactus plants are natives of California, Mexico and South America. Their peculiar appearance and structure is the result of the struggle to survive in very trying conditions. The cactus belongs to the family of plants known as "Xerophytes," the name being derived from two Greek words, *xeros* meaning dry and *phyton*, a plant. A xerophyte is a plant that can live with a very small amount of water.

The rose tinted flower of the night-flowering cereus. It is remarkable that such an ugly plant should have such a beautiful flower

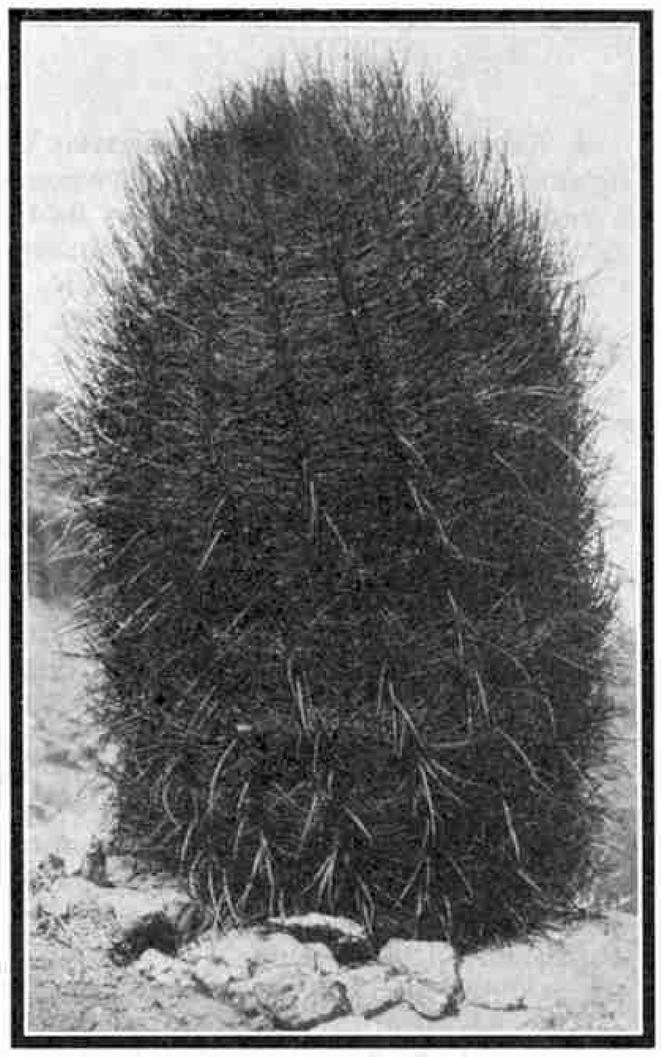
The cactus grows and flourishes in what must be regarded as the most difficult conditions possible for plants. The soil in which it grows is extremely dry and rain falls only at very long intervals. In order to be able to withstand these conditions the cactus has developed the power of storing up for future use the little water it receives. In addition, as compared with ordinary plants it breathes, as it were, very slowly, so that it makes its store of water last a very long time. The water is stored up in the thick fleshy parts that are so characteristic of the plant and it is astonishing how long this supply is maintained.



The water-barrel of the desert! The acrid liquid stored in this cactus has saved the lives of many travellers in the Colorado desert

A very noticeable feature of the cactus is that it carries no leaves, but instead usually has spines or spikes of various forms. There can be little doubt that these spines, some of which are very strong and of considerable length, form a very adequate defence against animals attracted by the greenness of the stem. On the other hand the cactus forms a very valuable food for cattle during time of drought and for this reason a variety known as Burbanks New Thornless cactus, which has no spines, is being planted on an extensive scale all over the deserts of Nevada and California.

One of the giants of the cactus family is the "*Cereus giganteus*," to give it its full Latin name. This plant flourishes in the wilds of the Colorado desert, and its appearance is most extraordinary. It attains a height of from 25 ft. to 60 ft. and each plant stands stiffly erect, giving the impression of a grotesquely distorted human hand. It is rather astonishing to think that such a weird-looking plant can produce flowers, but as a matter of fact in March and April it brings forth pearl-shaped, cream-coloured flowers of great beauty. The fruit ripens early in summer and it is often eaten by the desert Indians. This cactus stores up within itself a remarkably large quantity of liquid, which has a slightly acrid taste but forms a fair substitute for water. Many a man travelling across this blazing desert has had reason to bless the plant for it has been the means of relieving his agonising thirst and possibly of saving his life. Thus, the plant has come to be known as "The Water-barrel of the Desert."



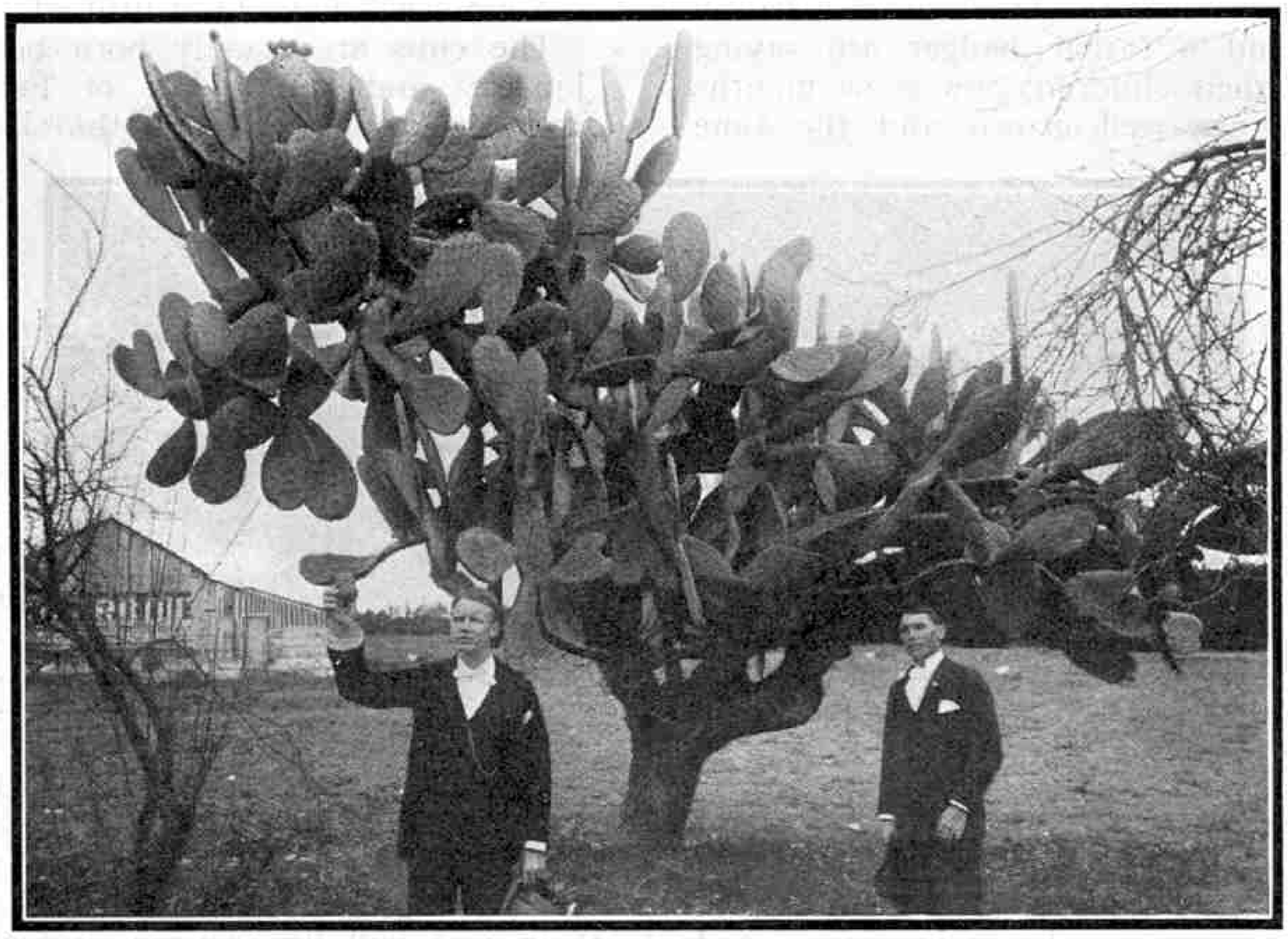
A toothpick cactus. A large specimen of this plant may contain as many as 10,000 spines

The common cactus of Mexico is the "Prickly Pear," of which there are no less than 150 species. In some places this

plant has been trained to form what is one of the most formidable hedges in the world, through which neither man nor beast can penetrate.

There are very many other interesting varieties of cactus, including the "Organ" cactus, the upright stems of which resemble the pipes of an organ; the "Old Man" cactus, so named on account of its beard; and the "Turk's Cap" cactus, the crown of which resembles a Turkish fez.

Many monster cactus plants have been brought to Europe from the deserts of California. The first really large living plant imported into England was brought to Kew about 50 years ago. It was one of the variety known as the "Hedgehog" cactus, on account of the enormous number of spines that it carries, and a mathematician estimated that on the specimen at Kew there were no fewer than 8,850! This giant plant turned the scale at 713 lb.



A giant "Prickly Pear" cactus growing on a farm in California

Plants of the "Hedgehog" group of cacti have the usual fleshy stems that distinguish these strange inhabitants of the desert, and practically all are armed with stiff short spines, usually set in little woolly cushions. One plant of this type that grows to an enormous height sometimes has as many as 50,000 spines, and the use that Mexicans make of the spines has led to its being called the "Tooth-pick" cactus!

In spite of their unattractive appearance, cacti are by no means useless. We have already seen that one of them is known as the water-barrel of the desert because of the store of moisture that it contains within its succulent stems; and many cacti are actually food-producing plants. The purple fruit of one of these resembles a gooseberry and is exceedingly good to eat; while the Mexicans eat the fleshy part of the stem of the same plant as a vegetable—after removing the spines, of course! From the crimson pulp within the fruit of another the Indians of the desert regions make an excellent preserve.

The most interesting of the cacti that produce an edible fruit is the "Prickly Pear," to which we have already referred. This plant is also known as the Indian fig cactus. The succulent branches of this remarkable plant are dotted over with tufts of hoofed spines. They bear yellow or reddish-yellow flowers that later are transformed into pear-shaped fruits, on the soft rind of which are tufts of small spines. Prickly pears are really excellent to eat, for they are both sweet and juicy. The plant that produces them is already extensively cultivated chiefly in the Canary Islands and in Southern Europe.

It is interesting to learn that a species of prickly pear is used on a large scale in cochineal plantations. This natural dye-stuff is extracted from the dried body of a small scale insect, which is cultivated on farms that are planted with the type of prickly pear that the insects favour.

The flowers of the cactus are almost as varied and fascinating as the shapes of the plant itself. It probably will surprise many readers to learn that it is quite possible, by the possession of a collection of cactus plants, to have a supply of magnificent blooms from the first of January to the end of December. Some plants produce a white flower, some a red; while others range in various shades from orange to purple. Many of the flowers also have a delightful and delicate fragrance. Some specimens produce from 50 to 70 blooms in a single season, while others flower only once and then merely for a few hours.

A particularly interesting plant is the Night-blooming Cereus. The flower of this plant is one of the most beautiful things in nature, and also, in its transition stages, one of the most interesting. At first small scales appear, which gradually increase in size and number to form a funnel-shaped flower. At this stage the flower, so far from being beautiful, is positively repulsive in appearance; but presently, as the night comes on, it throws off its outward ugliness and discloses the wonderful beauty of the perfect flower. Its inside colour is ivory tinted with delicate rose, and dozens of filmy stamens add to the exquisite beauty of the blossom, which also exhales a most delightful perfume.

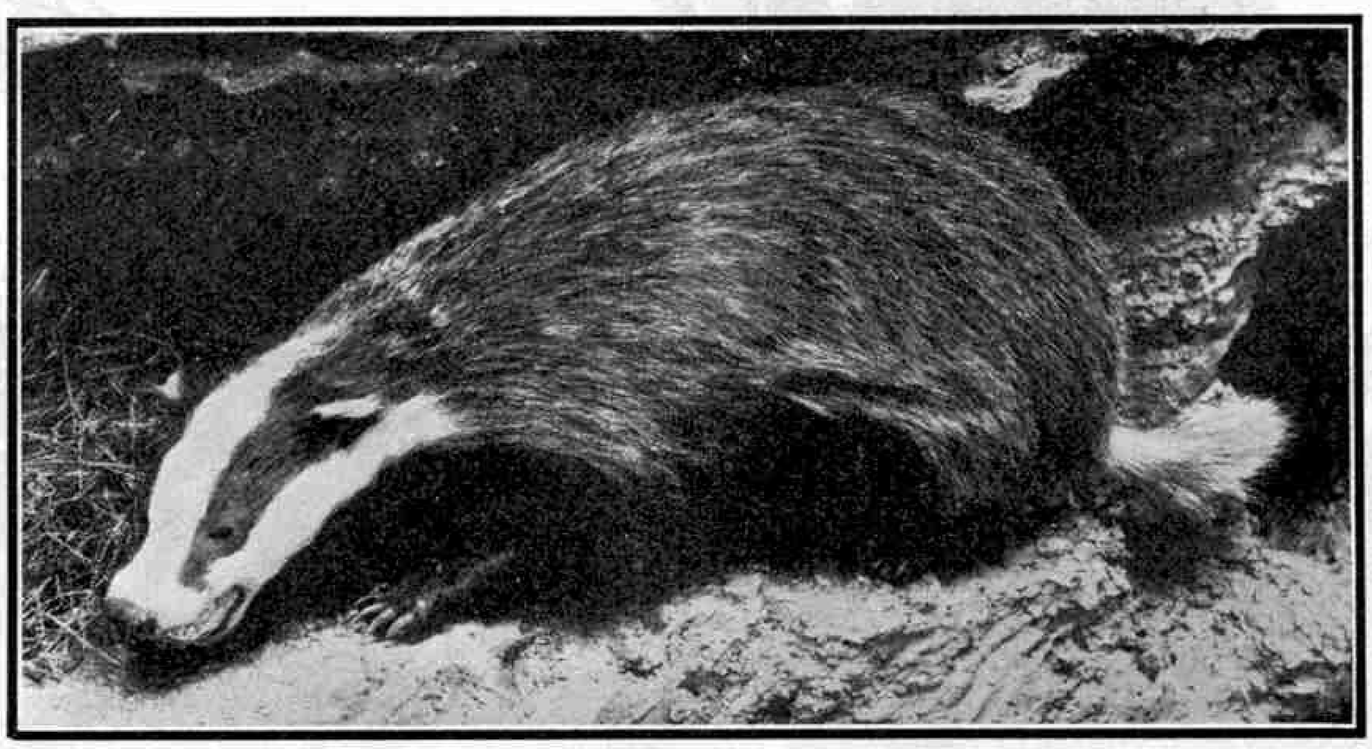
An even more remarkable plant is the "Lace" cactus that grows freely in Mexico. Most cacti have spines that are so sharp and stiff that they are capable of inflicting really nasty wounds, but the white spines of this dainty little plant are filmy and lace-like in appearance, and are so soft that the plant may be handled quite freely. The Lace cactus is low and barrel-shaped, and in the flowering season it is completely covered over by large blossoms that resemble hats with wide and floppy brims.

Many interesting cactus plants may easily be grown in this country, although most of them require a genial temperature. When growing they must be given plenty of water, which should always be tepid, and provision should be made for adequate drainage. It must be remembered that in their wild state these plants grow in sandy soil through which water percolates readily. At the end of the growing season water should be withheld, and the majority of cacti may be allowed to go dry until the return of the growing season.

Badgers at Home

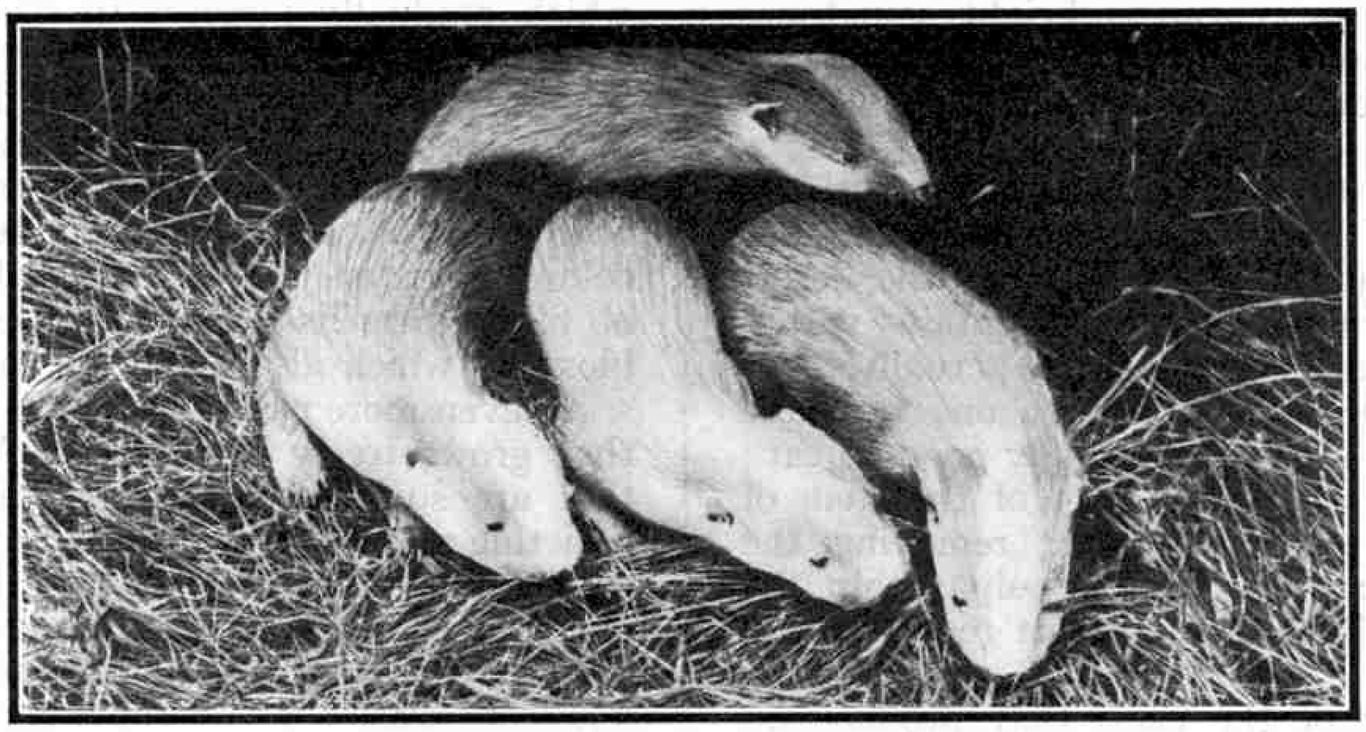
THE haunts of the badger are always fascinating, and particularly at this season of the year. When the night is slipping away, one hears startled screams and pitiful cries—it is the break-up of a happy family. A mother and a father badger are saying good-bye for ever to their children, now some months old. The youngsters are well grown and the time has arrived for them to leave the large, wonderful home in which their babyhood and youth have been passed, and go out into the world to make homes for themselves.

It is pathetic to see them in the moonlight, creeping back hesitatingly and timidly to the dark tunnels, only to be driven away by their parents. At length what is required of them dawns upon the slow minds of the little creatures. Silently and mysteriously they disappear, singly or in pairs; and father and mother are left alone and once more there is peace and quietness in the badgers' home.



Mr. Badger on the alert; a suspicious noise somewhere

This apparently heartless procedure is necessary in order to make room for another family of badgers and, as soon as the dismissal is complete, father and mother badger set to work, full of excitement yet methodically, to prepare a home for the new babies. Old nests are done away with, and the sides, roofs and floors of the many beautifully - domed tunnels are thoroughly scraped and the loose soil gradually worked outward into the open air. Sometimes also new tunnels are bored, with here and there a large open space to be used either as a bedroom or playroom for the youngsters.



Young badgers nearly ready to go out into the world

Food supplies also have to be considered seriously, for the winter will soon be here. Stores of acorns, crab-apples and nuts will be collected and put carefully away in little recesses in the walls of the tunnels. By the spring the berries and fruit will be tender and mellow, ready for the baby badgers who, when they suddenly come across them, will chuckle and scramble wildly for them. Finally there comes the making of the cradle which is, of course, a very important business. Before this is complete, not less than half a cart-load of dead, dry, bracken, and dead, dry leaves and grass will have been utilised.

The cubs are usually born between the middle of January and the middle of February, and number from two to five. When the size of their parents is taken into consideration they are indeed tiny. The combined weight of the parents may be as much as 70 lbs., yet the newborn cubs will not be more than four inches in length and will not weigh more than three ounces each. They are blind and deaf, and have a skin of a bluish shade.

Look at them again in a week's time, and you will hardly recognise them. They will have grown quite a couple of inches in length, their eyes will be opening, and they will be covered with a thin, wiry growth of blue hair. A little later all the familiar badger characteristics make their appearance—the white tips to the black ears; the black between the muzzle; the black markings on the white face, and the heavy silver-grey coat.

The youngsters are fully a month old before they begin to go into the open air and forage with their parents. By this time they weigh about 6 lb. each and their jaws, already strong, bristle with needle-like teeth. Their play is very similar to that of baby pigs—that is, it is an affair of fits and starts. First there is a spasmodic rush, followed by a few snorts and grunts and snaps, and the game is over. All become sedate and serious again, nosing their way through the herbage.

The animals are rather fastidious feeders, and live chiefly on vegetation. They love honey and honeycomb, and all the bumble-bee and wasps' nests within a radius of a few miles are soon found and dealt with very quickly. Even the bees and the wasps themselves are eaten! It might be thought that the badgers would be driven away by the attacks of the angry insects, but

as a matter of fact their covering of hair is so thick as to afford complete protection against stings. Even if an insect could find a bare place it is probable that its sting would not worry the badger much on account of the toughness of its skin and the looseness with which it lies on the body.

The menu of the badger includes also mushrooms, baby rabbits, some of the wild bulbs, and snails. It is an interesting fact that badgers never take any food into their home except the stores for winter use that have already been mentioned.

In the aggregate there must be some hundreds of badgers in the Home Counties, in the south-western counties and in the Midlands, but further north and in Scotland the animals are now rare. The heights of Hampstead were once a favourite resort of the badger, and may be so still. Richmond Park was another favourite place, while up to only a few years ago there were badgers in plenty at Woodmansterne, near Purley, in Surrey, and on the hillsides in the Chipstead Valley, and in the vicinity of Merston.

The badger is a persecuted animal and has few friends. There is little justification for this, however, for although he may occasionally be guilty of stealing a few eggs or young birds, he does not do this systematically, and he certainly earns our gratitude for the enormous number of wasp larvæ that he destroys. Except when roused the badger is an inoffensive animal, but he is capable of inflicting a very severe bite and is full of courage. It was these characteristics that led to the brutal sport known as "badger baiting," in which the animal was placed in a barrel and made to fight for its life against dogs. This practice was quite common in England up to about 1580, when it was prohibited. The modern form of this "sport" consists in setting men to dig the badger out of his burrow, to fall a prey to waiting dogs.

We have mentioned that the badger is capable of inflicting a severe bite. This is due not only to the fact that its teeth are long and sharp, but also that its jaws are so formed that when it closes its mouth the jaws lock together on account of a peculiar structure of their junction with the skull. Once a badger has got his teeth well home, therefore, it is extremely difficult to make him relax his hold. A striking demonstration of this is described by Sir Alfred Pease in his book on the badger. A keeper inserted his arm into a badger's burrow, and the animal seized him by the wrist and held him, with arm outstretched, for ten minutes. When the badger let go his hold, and the keeper was able to withdraw his arm, it was found that the wrist was so terribly bitten that the hand had to be amputated.

A tame badger at the age of six weeks. The characteristic head markings are well developed

In Canada the badger is trapped in large numbers for his fur. Some idea of the extent to which he is slaughtered there may be gained from the fact that during the season 1927-28 no less than 33,516 badger pelts were taken.

It would be a great pity if we lost the badgers. They are interesting in very many respects and their intelligence is beyond dispute. They go to enormous trouble to make the tunnelling of their homes as perfect as possible. They show the utmost care in bringing up their children, and in their habits they show a refinement and a love of cleanliness that few animals can equal.

The characteristics of the badger are very well summarised by Professor J. A. Thomson in "*The New Natural History*":—"Moreover, the badger has strong virtues of its own. It is a very muscular animal, with a first-class heart and circulation, and a good wind. The lower jaw works in a socket so deep that dislocation is almost impossible, and the grip is unsurpassed in tenacity. Its thick coat helps the badger to withstand the cold of winter, and it also stores a good deal of fat. Furthermore, it is endowed with keen senses, shrewd intelligence and a capacity for taking things easily. It is more alert than it looks, it is at once cautious and cunning, it is dogged without being obstinate, and it does not fuss or worry. It is a creature with a great deal of character and strong idiosyncrasies."

A baby badger making a "personally conducted tour" of the lawn

Apart from his many engaging qualities the badger commands our respect by reason of his ancient lineage. How far back his history goes we do not know, but he is certainly one of the oldest known species of mammal now living. Linnæus, the famous naturalist, regarded the badger as belonging to the bear family, but the animal is now regarded as being allied to the weasel.

A badger caught young makes an exceedingly interesting pet. It soon becomes quite friendly and its intelligent ways are very attractive. It is not in the least disposed to be pugnacious, and will never use its teeth unless it is irritated.—J. C. Bristow-Noble.

New Meccano Model

Revolving Fly-Boats

(Concluded from last month)

IN last month's article dealing with the construction of this model we described the base frame, to which the main standards are secured, and also the eight passenger cars. The units now remaining to be built are the two main standards, the wheel frame, and the motor unit, and the construction of these is accordingly dealt with in this article.

The Main Standards

In constructing the two main standards, reference should be made to the general view of the Flyboats that appeared in last month's article. Fig. 3 on this page shows the upper portion of one of these units. As will be seen from Fig. 1 channel-section girder construction has been employed in building the standards, this method eliminating any tendency to "whip" or twist when the wheel is in motion.

The standard proper consists of two pairs of 18½" Angle Girders 13 (see Fig. 3) bolted together by means of 9½" Flat Girders 14, Washers being placed under the heads of the bolts holding these to the Angle Girders in order to prevent the bolts slipping in the slots of the Flat Girders. The channel-section girders thus formed are bolted at the bottom to two 12½" Angle Girders, which in turn are secured to the base frame of the model, while their upper ends are kept the correct distance apart by means of 5½" Strips.

The bearings in which the axle carrying the wheel rotates consist of Girder Frames 16 (Fig. 3), these being bolted to the top holes of the vertical columns. Triangular Plates 17 are secured to the Girder Frames and also to the 5½" Strips 15, and form the upper point of attachment for the two inclined columns or ties.

Each of the inclined columns consists of a rigid channel-section girder built from 18½" Angle Girders 13 that are spaced apart by Flat Girders 14 bolted securely to their flanges. The columns are attached at the base to the lateral 12½" Girders to which the vertical members are also bolted, while bolts passed through the 1" Triangular Plates 17 anchor them at the top.

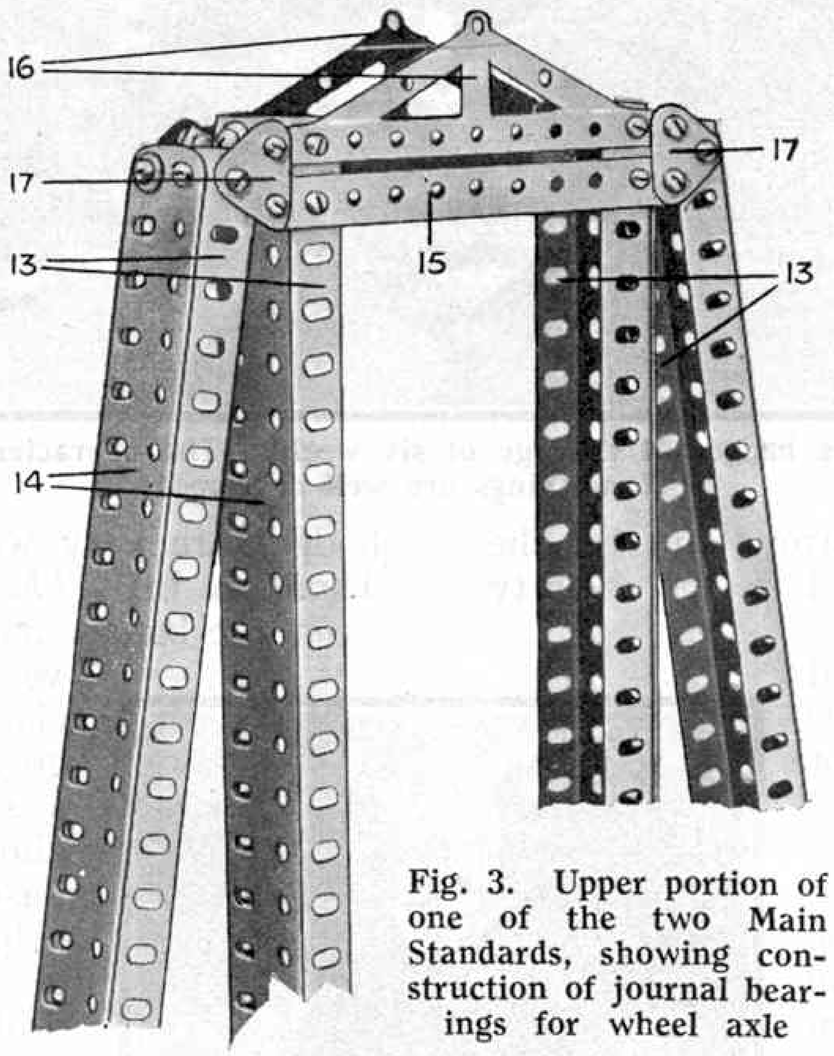


Fig. 3. Upper portion of one of the two Main Standards, showing construction of journal bearings for wheel axle

In completing these units, great care should be exercised to see that everything is in alignment and that all bolts are screwed down firmly, as the true running of the wheel depends to a large extent on the rigidity of its journal supports.

Building the Wheel Frame

The revolving wheel that carries the eight cars is shown in Fig. 4. Each side is composed of eight arms, each of which consists of a 12½" Strip 18 that is secured by means of two bolts to a centre Face Plate 21. 5½" Strips 20 bolted to the Strips 18 serve to hold the whole rigidly together.

After building two similar sides as described, they may be joined together by means of 3½" Double Angle Strips 19, which are secured in position between each opposite pair of Strips 18. It is important that care is taken to ensure that the bosses and central bores of the two Face Plates are directly in line so that the wheel will revolve quite true about its axis when the various parts of the model are finally assembled. To align the Face Plates correctly it is advisable to place a length of Meccano Rod through their bores and then carefully re-adjust the Double Angle Strips 19 until the wheel runs free and true on the temporary axle. A little care is all that is necessary to construct a perfectly balanced wheel that will run smoothly and evenly.

PARTS REQUIRED:

16	of No.	1	4	of No.	9e	8	of No.	48b	2	of No.	97
20	„ „	2	1	„ „	13	8	„ „	52a	1	„ „	98
1	„ „	2a	8	„ „	15a	3	„ „	53a	4	„ „	99
32	„ „	4	2	„ „	16a	37	„ „	59	16	„ „	103a
32	„ „	5	2	„ „	17	3	„ „	70	4	„ „	108
20	„ „	6	1	„ „	26	8	„ „	77	2	„ „	109
32	„ „	6a	2	„ „	27a	32	„ „	90a	4	„ „	113
16	„ „	7a	2	„ „	30	4 ft. 2 in.	„	94	1	„ „	126
15	„ „	8	1	„ „	32	1	„ „	95	2	„ „	161
3	„ „	9	428	„ „	37	1	„ „	95b	6-Volt Motor		
2	„ „	9b	41	„ „	38	1	„ „	96			
9	„ „	9d	48	„ „	48a	1	„ „	96a			

Assembly of the Main Units

Having completed the various portions of the model it remains now to assemble them in their respective positions. The first step is to attach to the base the two vertical standards that support the wheel. As will be seen from the general view the standards are bolted one at either side of the base. The bolts securing each standard pass through the lateral 12½" Angle Girders and through the fourth and seventh holes of the Flat Plates 5, counting the holes from the sides of the base (see general view included in last month's article).

To ensure perfect rigidity it is advisable to further

secure each standard to the base by means of bolts and nuts passed through the 12½″ Girders about midway along their length. Having made sure that the main standards are perfectly secure, attention may be given to the moving parts of the model.

The wheel (Fig. 4) revolves on an 11½″ Rod and to place it in position between the standards, the Rod should first of all be passed through the apex holes of the Girder Frame 16 (Fig. 3) of the outer standard. The wheel may now be placed between the standards and the 11½″ Rods passed through the Face Plates 21 (Fig. 4), then through the apex holes of the Girder Frames capping the opposite standard. It is held in position by means of two Collars secured to the Rod one at each end and placed against the faces of the Girder Frames 16. The wheel should be secured centrally on the Rod by tightening the set-screws of the Face Plates 21.

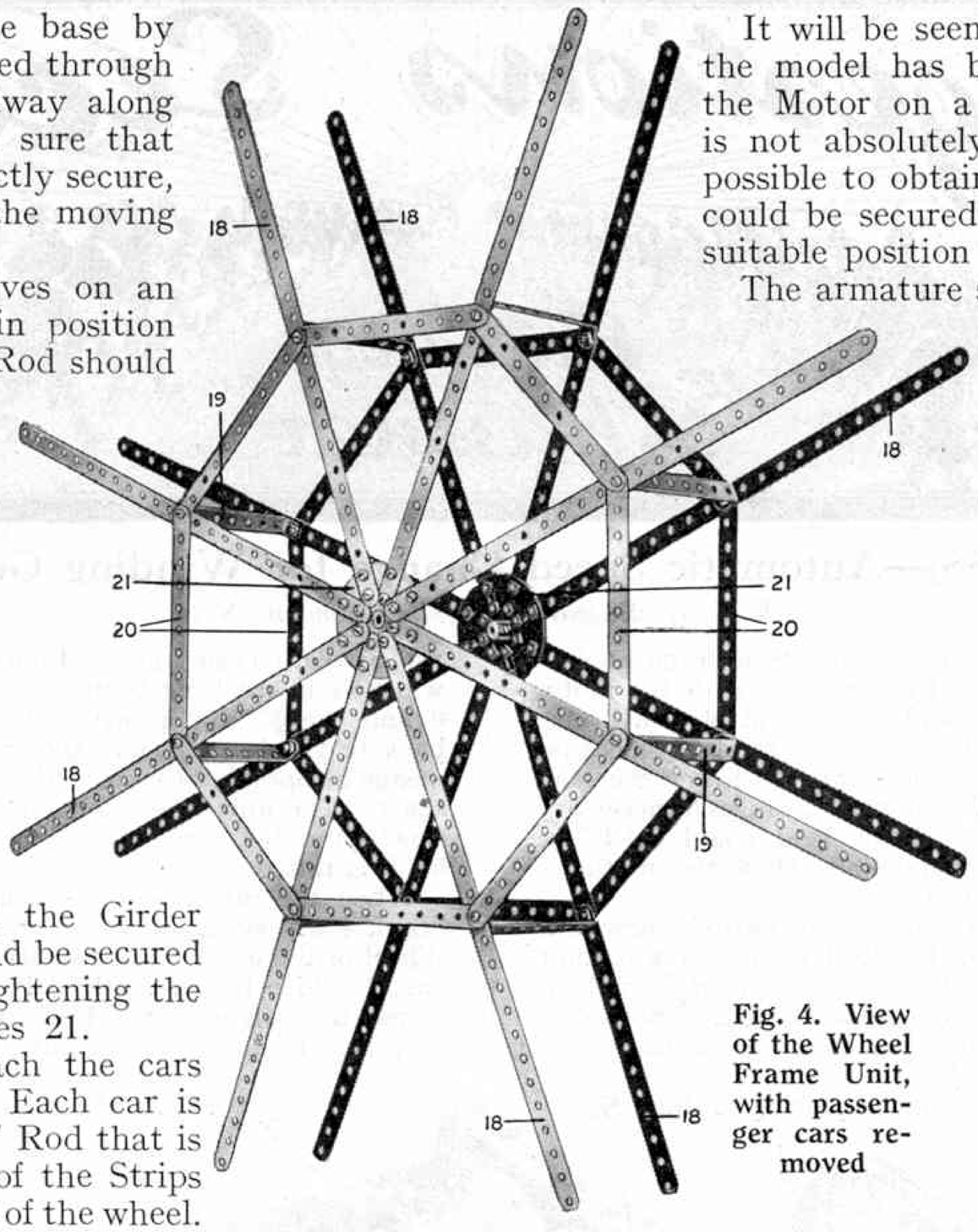


Fig. 4. View of the Wheel Frame Unit, with passenger cars removed

The next step is to attach the cars to the arms of the wheel. Each car is suspended pivotally on a 3½″ Rod that is journalled in the end holes of the Strips 18 (Fig. 4) that form the arms of the wheel. This Rod passes through the upper end holes of the 2½″ Strips attached to the cars and is held in position in the arms of the wheel by means of two Collars. As all the cars are suspended freely on their respective pivot Rods it will be found that as the wheel is rotated the cars maintain a horizontal position.

The Chain Drive Mechanism

The mechanism for rotating the wheel is very simple. A study of Fig. 1 in conjunction with the following description should make its arrangement quite clear.

The drive is taken from a 6-volt Meccano Electric Motor screwed down in the position shown to the wooden baseboard on which the model itself is mounted. On one end of the 11½″ Rod on which the wheel revolves is a 2″ Sprocket Wheel that is connected by a length of Sprocket Chain to a 1″ Sprocket that is secured to a short Rod carrying a 3″ Sprocket. The Rod of the latter Sprocket is journalled in the centre holes of the Angle Girder 12 of the vertical standard and held in position by means of Collars.

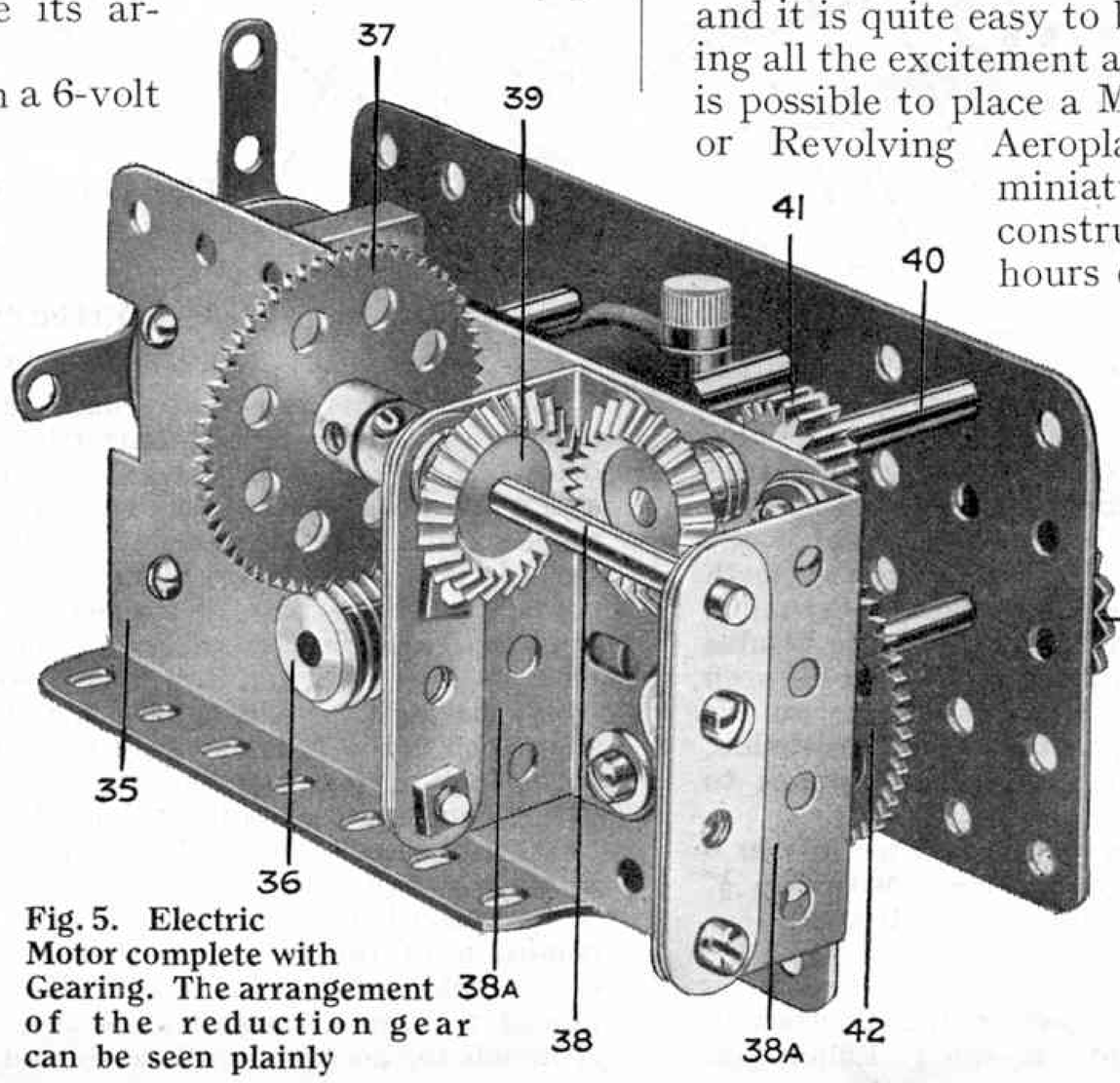


Fig. 5. Electric Motor complete with Gearing. The arrangement of the reduction gear can be seen plainly

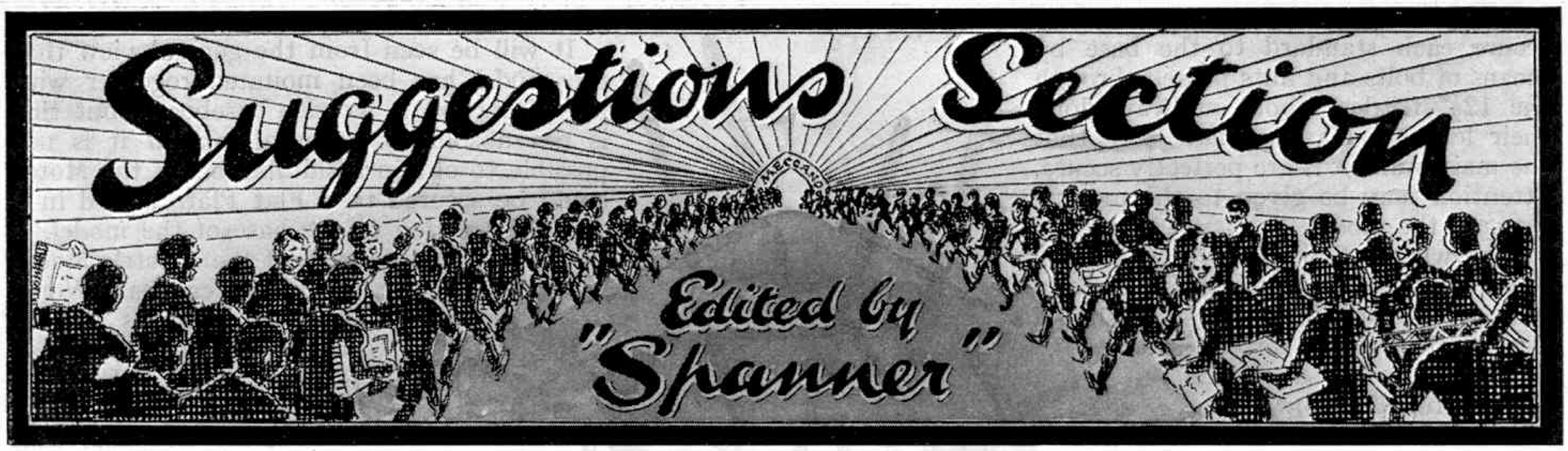
It will be seen from the general view that the model has been mounted together with the Motor on a wooden baseboard, but this is not absolutely essential, and if it is not possible to obtain a suitable board the Motor could be secured to a Flat Plate bolted in a suitable position to the base of the model.

The armature spindle of the Electric Motor 35 (Fig. 5) carries a Worm 36 that engages a 57-teeth Gear Wheel 37 that is secured on a Rod 38. This Rod is journalled in two Girder Brackets 38a, which are bolted to the Motor casing. Two or three 2″ Strips are bolted to each face of the Girder Brackets in order to give additional bearing surface to the Rod. In addition to the Gear 37 the Rod 38 carries also a Bevel 39 that engages with a second Bevel secured on a Rod 40, on which is mounted also a ½″ Pinion 41. The Rod 40 is journalled in the side plates of the Motor and is held in position by a Collar placed on the end of the Rod opposite to the Bevel. It is advisable to place one or two Washers on the Rod 40 between the Bevel and the Motor, to ensure the proper engagement of the Bevel teeth.

The ½″ Pinion 41 engages a 57-teeth Gear 42 carried on a Rod that is journalled in a manner similar to the Rod 40. On this Rod, and placed outside the Motor casing, is a ¾″ Sprocket 43, which is connected by a length of Sprocket Chain to the 3″ Sprocket of the model driving mechanism (see Fig. 1).

In motion, this model presents a most pleasing sight and it is quite easy to believe that one is actually enjoying all the excitement and fun of a real fair ground. If it is possible to place a Meccano Roundabout, Joy Wheel, or Revolving Aeroplane, alongside the Flyboats a miniature fairground may readily be constructed and heaps of good fun and hours of pleasure will be obtained. The No. 4-7 Meccano Instruction Manual contains full details for building the Revolving Aeroplanes, Joy Wheel, Big Wheel, and a Cake Walk, besides hundreds of other equally fascinating models.

Full instructions for building the Meccano Revolving Flyboats, together with sectional illustrations that make every detail clear, are contained in the Special Super Model Instruction Leaflet No. 33. In addition, the leaflet also deals with the construction of a larger model Flyboat incorporating two revolving wheels. The leaflet may be obtained from any Meccano dealer, price 3d., or direct from Meccano Ltd., Old Swan, Liverpool, price 3d. post free (Overseas 4d., Canada 8 cents).



(168)—Automatic Speed Change for Winding Gear

(S. C. G. Buszard, Finchley, London, N.3)

ONE method of lowering the load attached to a crane hook is by throwing the hoisting barrel out of gear with the motor and allowing the load to descend under control of a brake. If this method is not practicable for reasons of safety or because of the dimensions of the load, it is necessary to lower the load by reversing the hoisting motor. This however, causes unnecessary waste of power; also in many cases the load could safely be lowered at a greater speed than is possible when the motor is in gear with the winding mechanism.

The gear box shown in Fig. 168 provides an entirely new and very interesting method of handling the load in such a way that these objections do not apply. It should work extremely well in all kinds of Meccano cranes, and although we have no knowledge of a similar gearing actually in use, there seems to be no reason why it should not prove practicable.

The idea in brief consists in arranging the gearing so that the load is hoisted at a slower rate of speed than that at which the lowering operation is accomplished. The alteration in the speed is obtained entirely automatically on reversing the direction of rotation of the Motor.

The sides of the gear box are formed from $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates which are connected together by $4\frac{1}{2}''$ Strips and mounted on $5\frac{1}{2}''$ Angle Girders. The hoisting barrel is represented by a Wood Roller (part No. 106) and the drive from the Motor may be applied to the 3″ Pulley on the Rod 1.

The Rod 1 may be termed the mainshaft of the gear box, for it is the one from which the various gears derive their motion. It carries a unit 9 which consists of two 1″ Gears held together by a Socket Coupling. The unit is free to revolve on the Rod, and it is prevented from moving sideways by Collars. A $\frac{1}{2}''$ Pinion is secured to the mainshaft in the position indicated in the illustration.

A 1″ Gear Wheel 5 is fixed to a Rod 11 and next to it is a Double Arm Crank 4, freely pivoting on the Rod 11. This Crank carries a 3″ Strip so that one of its arms is prolonged 2″, and a $\frac{1}{2}''$ Pinion 3 is free to turn about a $\frac{3}{4}''$ Bolt on its shorter arm. Also on the Rod 11 is the unit 2, which consists of a $\frac{1}{2}''$ Pinion and a 57-teeth Gear Wheel connected together by means of a Socket Coupling. The Pinion is in constant mesh with the Pinion 3 on the Double Arm Crank, and a Compression Spring is placed on the Rod between the Crank and the unit 2. The latter is of course free on the Rod 11. Finally a $\frac{3}{4}''$ Pinion is secured to the Rod (this Pinion, besides forming part of the driving mechanism, also serves to retain the unit 2 in its correct position).

A third Rod journalled in the gear box carries a 50-teeth Gear 6 and 1″ Gear 7, the latter being arranged to mesh with the $\frac{1}{2}''$ Pinion 3 and the former with the $\frac{3}{4}''$ Pinion on the Rod 11.

Action of the Mechanism

With the mechanism in the position shown in the illustration, the motion of the shaft 1 is transmitted via the $\frac{1}{2}''$ Pinion and the 57-teeth Gear and $\frac{1}{2}''$ Pinion of the unit 2, to the Pinion 3, which is in mesh with the 1″ Gear Wheel 7. The 50-teeth Gear 6 and the $\frac{3}{4}''$ Pinion with which it is in mesh brings the drive back to the Rod 11, and the motion of the latter is conveyed by means of Sprocket Chain to the Sprocket Wheel 10 on the winding shaft. The unit 9 revolves idly. The hoisting drum now rotates slowly and the cord should be wound round it so that the crane hook is raised.

When the direction of rotation of the shaft 1 is reversed the Crank 4 will swing over and come into engagement with the Gear Wheel of the unit 9, and the drive will then be transmitted via the unit 2, which is constantly driven from the $\frac{1}{2}''$ Pinion on the Rod 1, and the unit 9, to the 1″ Gear Wheel 5, which is secured to the Rod 11. In this case the further Rod carrying the Gears 6 and 7 performs no useful work, but merely revolves idly. The hoisting drum now rotates at a greater speed, lowering the load. The Compression Spring on the Rod 11 presses the boss of the Double Arm Crank lightly against that of the Gear Wheel 5 and thus aids the Crank to swing over when the direction of rotation is changed. The movement of the Crank is checked at each end of its swing by the end of the 3″ Strip coming into contact with a $4\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip; one of the two Double Angle Strips required may be seen at 8. This prevents the $\frac{1}{2}''$ Pinion 3 jamming itself between the 1″ Gears that it drives.

With a little modification the device may be incorporated in practically any type of Meccano crane.

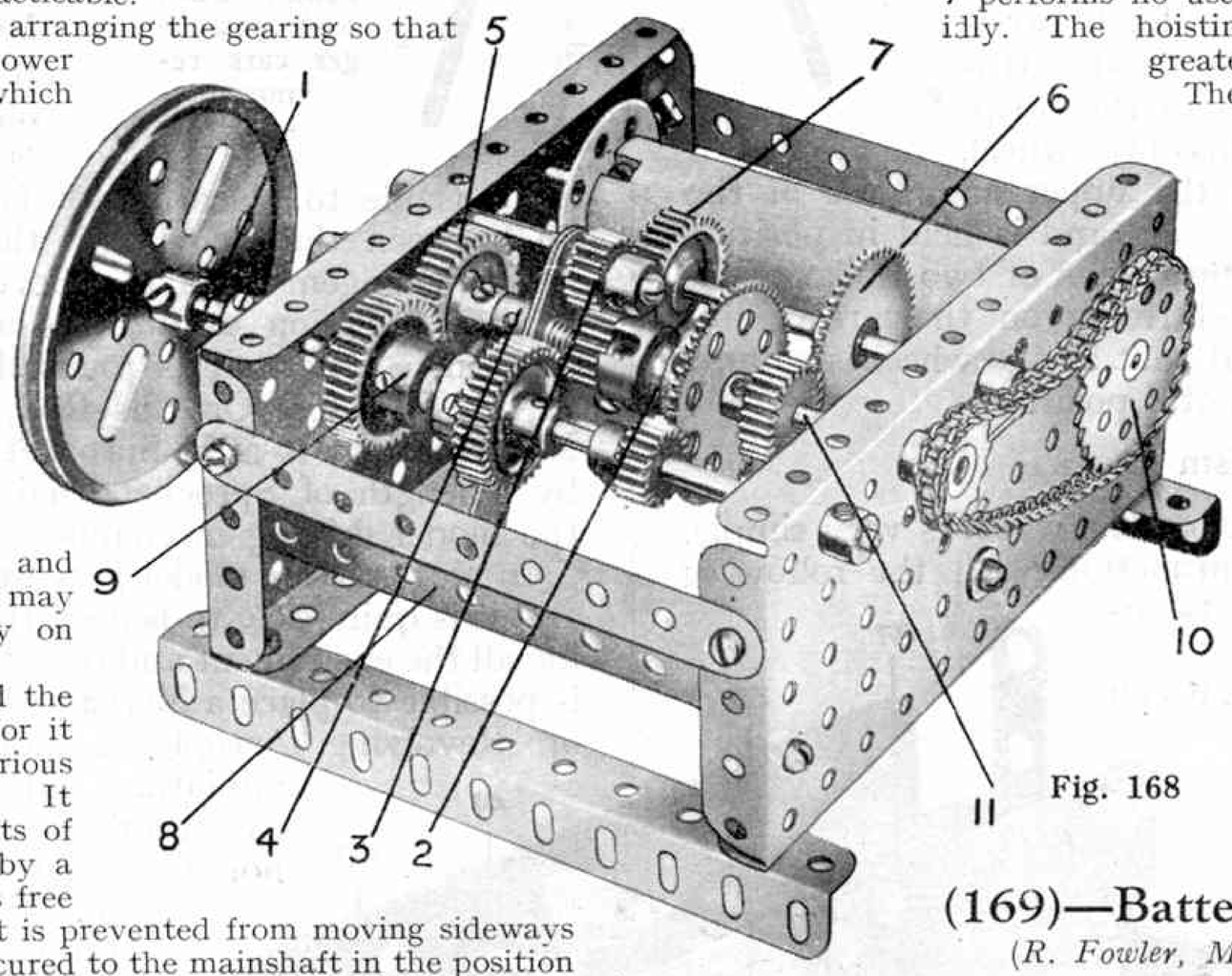


Fig. 168

(169)—Battery Tester

(R. Fowler, Manchester)

Those of our readers who make use of 'flash lamp' or other types of low voltage dry batteries will find the testing device described below useful, as it will enable them to keep a check on the condition of their cells. The tester consists of a Meccano Lamp Holder, in which is placed a 6 B.A. Bolt. On this Bolt a $2\frac{1}{2}''$ nickel Strip is placed so that it makes electrical contact with the base of the screwed portion of the Holder. A Meccano Insulating Fibre Bush is next placed on the 6 B.A. Bolt with its raised portion downwards so as to insulate the $2\frac{1}{2}''$ Strip from the Bolt. To complete the device a further $2\frac{1}{2}''$ Strip is slipped on to the Bolt and held in position by means of two 6 B.A. Nuts, lock-nutted together, the Nuts being adjusted so that the Strips can rotate smoothly about the 6 B.A. Bolt.

When using the device for testing 4.5 volt flash lamp batteries, a 3.5 volt bulb should be screwed into the Holder, and the two Strips placed upon the respective poles of the battery. The condition of the cells will then be indicated by the brilliance of the light emitted from the bulb. The device can also be employed to form a rough test of the condition of an accumulator, although for accurate work a volt-meter is to be preferred.

(170)—New Car Springing Device

(J. P. Smith, King's Lynn)

It is not an easy matter to design the means of suspending the chassis of a high power motor car, for the chassis springs must permit of comfortable travel even over the roughest of roads, and at the same time they must be strong enough to give long service and withstand tremendous strains.

One would imagine however, that the problem has been satisfactorily solved, for the modern motor car has a beautifully smooth and easy motion. Nevertheless, motor engineers are continually trying to effect improvements.

The device illustrated in Fig. 170 shows an interesting departure from the usual type of rear axle spring suspension. When the complicated nature of the mechanism is taken into account, however, it is doubtful whether it holds any great advantage over the more orthodox forms. The model has purposely been constructed in a very simple manner in order that its principles may be followed clearly. With little or no alteration it may be fitted into any Meccano motor chassis.

In the illustration, the road wheels are represented by 3″ Pulleys that are secured to the ends of an 8″ Axle Rod. The Rod is journalled freely in the bosses of two Cranks that, in turn, are bolted to two further Cranks secured to the ends of another Rod. This latter Rod is carried in Trunnions that are bolted to the underside of side Girders of the chassis, and has secured to it two more Cranks.

Four Springs are attached to the last-mentioned Cranks by 1″ Screwed Rods. Two pairs of the Springs are attached to a Rod mounted between the side Girders of the frame, and the remaining two pairs are anchored to the rear end of the chassis. The loops of the Springs are passed through the slotted holes of the Angle Girder forming the rear of the chassis frame so that they project sufficiently far for an Axle Rod to be passed through them. This Axle Rod it will be seen is secured in Handrail Supports bolted to the Girder.

Although Springs are employed in the Meccano model for the flexible members, the actual system makes use of a number of rubber discs for these parts. The discs are mounted close to each other upon rods, and at either end of the compression unit thus formed, metal caps are placed, these caps being anchored to girders secured laterally in the frame of the chassis.

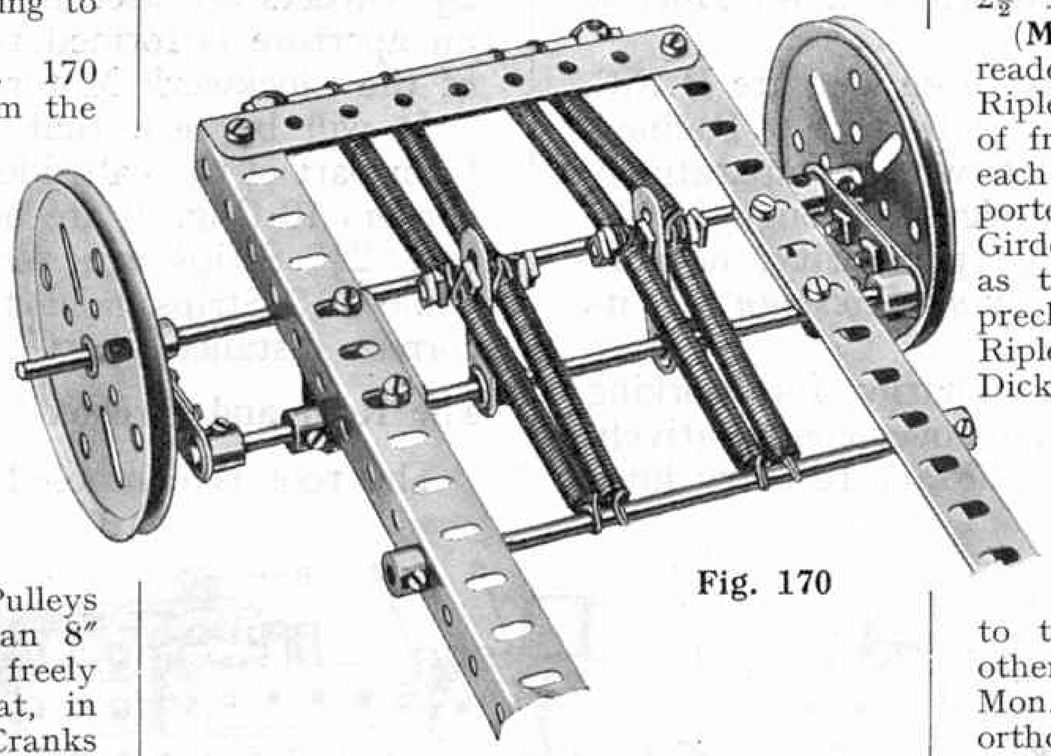


Fig. 170

(171)—Apparatus for Determining Bending Stresses

(J. H. Palmer, Burnside, Near Kendal)

The power of resistance of a girder under a bending stress varies greatly according to the shape of the girder. A Meccano Strip will bend quite easily across its wide surface, but when an attempt is made to bend it across its narrow surface great force must be exerted to produce any noticeable deflection. Therein lies the reason for constructing built-up girders in certain shapes to resist stresses applied in definite directions.

The apparatus shown in Fig. 171 is used to ascertain the bending or deflection of Meccano Girders and Strips under load, and it should be of interest to those "*M.M.*" readers who are scientifically inclined.

The specimen 1 under test is laid upon the up-turned edges of 4½″ Angle Girders that are bolted to the top Girders of the framework. (The position of these girders may be varied of course to suit specimens of different lengths).

The Pointer that records the deflection of the specimen is secured to one end of a Rod 2, which is journalled in the Sector Plates, and a scale is attached to one of these Plates. A length of cord is tied to a Collar on the Rod, wrapped once or twice round the Rod, and then is secured to a Hook which may be attached to the centre point of the specimen.

Matters should be so arranged that with no added weight on the specimen the Pointer is at the "zero" end of the scale. Then, on adding the weights 3, the Pointer moves across the scale to a greater or lesser degree according to the stiffness of the specimen and the number of weights. A Meccano 25-gramme Weight 4 fixed to a length of cord that is wrapped round the Rod 2, serves as a counterbalance and returns the Pointer to zero when the load is removed.

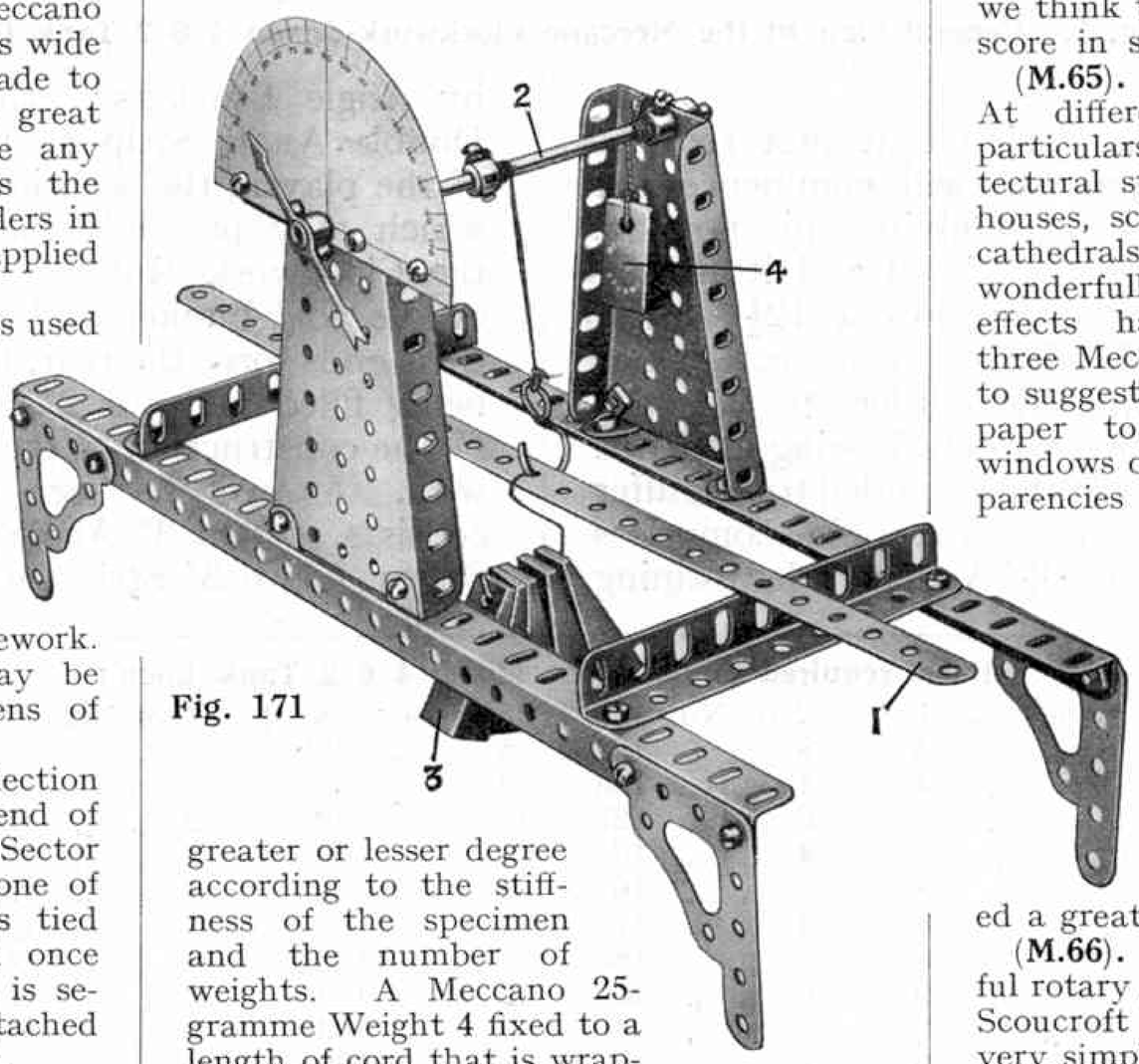


Fig. 171

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

(M.62). New Gear Ratio.—According to D. Lawford (Golders Green, N.W.11) a new gear ratio may be obtained by meshing a ¾″ Pinion with a ½″ Pinion. They will mesh if the Rods on which they are mounted are journalled one in the centre hole and the other in the middle hole of a side row of a 2½″ Triangular Plate.

(M.63). Meccano Frame Aerial.—Two readers (R. Dickson, Dundee, and F. Ripley, St. Helens) have submitted models of frame aerials, the principal feature of each being the fact that the wire is supported on a cross consisting of Angle Girders. The best wire to use is Electron, as this is very heavily insulated, thus precluding the possibility of leaks. While Ripley's model is mounted on a fixed base, Dickson's is provided with ball bearings on which the frame may be turned easily in any direction for locating various stations.

(M.64). Reverse Drive.—There are several well-known methods by which two rotating shafts may be made to turn in opposite directions to each other, but H. Lewis (Pontypool Road, Mon.) suggests a novel departure from the orthodox. Two 3″ Pulleys are mounted in a suitable manner 4″ apart centre to centre. A 4½″ Strip, carrying an Eye Piece, is attached pivotally at its ends to the Pulleys by lock-nutted bolts, while the Eye Piece is pivoted to the framework of the model at a point midway along the centre line of the wheels. When one Pulley is revolved the other turns in the reverse direction under the influence of the 4½″ Strip, the movement of which is of a combined oscillating and reciprocating nature. The movement of the mechanism is decidedly jerky, to overcome which a heavy flywheel would be necessary, and although the device certainly is novel we think that the more orthodox methods score in simplicity and efficiency.

(M.65). Meccano Models of Buildings.—At different times we have received particulars of Meccano models of architectural structures of all kinds, including houses, schools, town halls, churches and cathedrals, and in several cases some wonderfully realistic and very artistic effects have been obtained. Two or three Meccano boys have recently written to suggest the use of coloured transparent paper to represent the stained glass windows of ecclesiastical buildings. Transparencies suitable for the purpose may be obtained from most household stores, and if carefully cut with regard to the design, some very realistic windows may be formed. A model cathedral equipped with coloured windows fashioned in this manner and lighted electrically from inside was recently exhibited in the window of a Meccano store, where it attracted a great deal of attention.

(M.66). Meccano Grinder.—A very useful rotary grinder has been sent in by J. B. Scoucroft (Torquay). Its construction is very simple; it consists merely of a small emery wheel, which may be purchased quite cheaply, mounted on the spindle of the Clockwork or Electric Motor.

New Meccano Model

Clockwork-Driven Pacific Type Express Passenger Tank Locomotive

OUR model this month is of a Pacific type tank locomotive of particularly pleasing appearance. It is driven by a Meccano Clockwork Motor incorporated in the firebox, and will run on Hornby Rails (Gauge 0).

Many of our readers (especially those who are H.R.C. members) will know that the 4–6–2 or "Pacific" type of wheel formation is met with comparatively rarely in British tank engine design, although in the tender engine it has considerable popularity, notably on the L.N.E.R., where the "*Flying Scotsman*" is its most famous exponent.

A tank engine is designed primarily for working freight or suburban passenger trains over comparatively short distances, when it is not necessary to carry huge quantities of coal and water. Nowadays, however, express passenger trains running over distances ranging from 50 to 100 miles are frequently hauled by tank engines, and it is this type of locomotive, which may be known as the express passenger tank, that the model illustrated on this page is intended to represent.

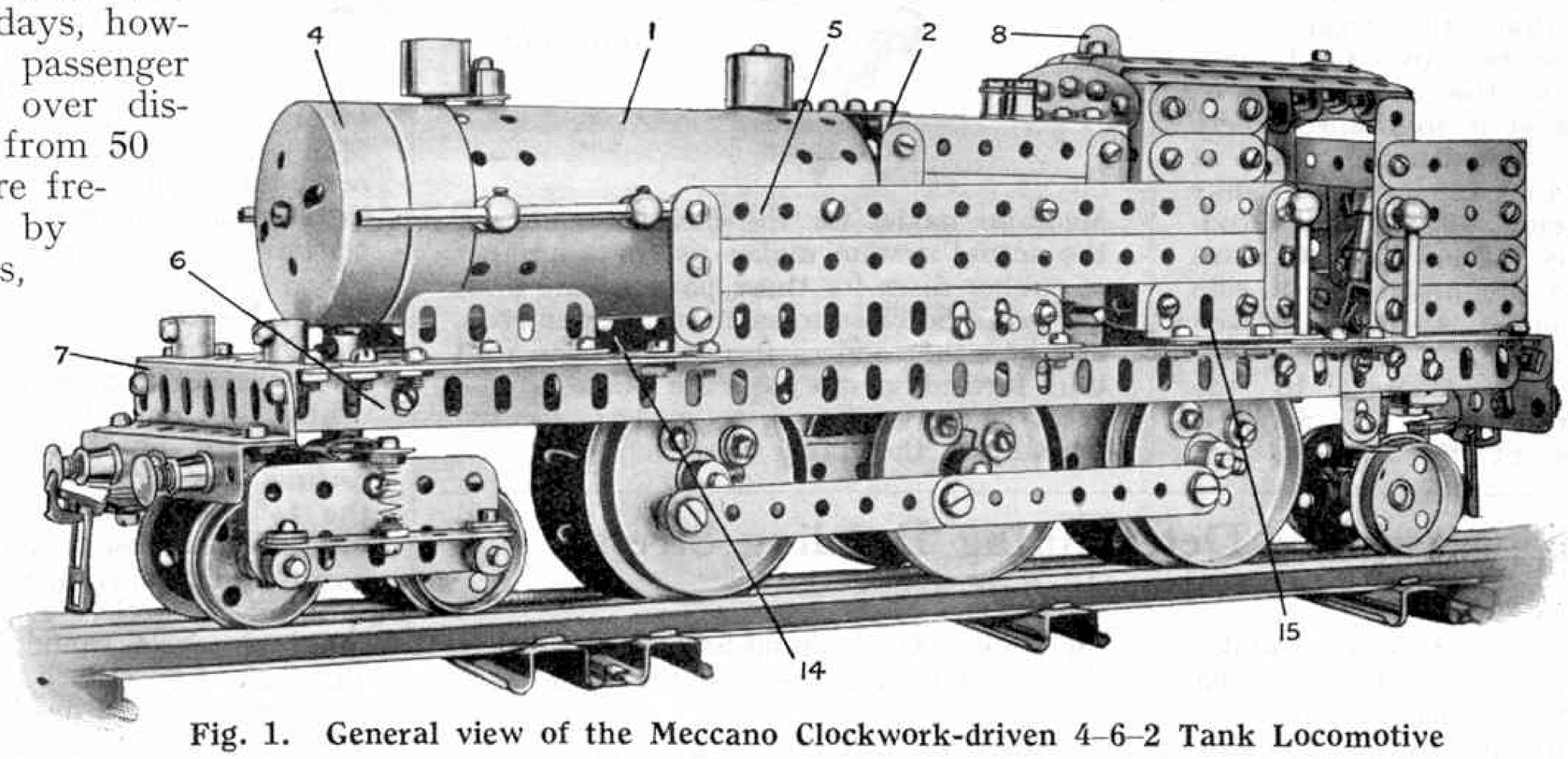


Fig. 1. General view of the Meccano Clockwork-driven 4–6–2 Tank Locomotive

As it is the frame of the engine that first receives attention in the engine shop, we will commence the construction of the model by assembling this portion.

The frame is shown clearly in Fig. 3 and it will be seen that each side member comprises a $12\frac{1}{2}''$ Angle Girder extended by a $3\frac{1}{2}''$ Girder. The rectangular frame is completed by bolting $3\frac{1}{2}''$ Girders to the ends of the side members, additional Girders 7 being attached at the front of the frame to form the extended front buffer beam. The buffer beam at the rear of the engine comprises a $3\frac{1}{2}''$ Flat Girder secured to the $3\frac{1}{2}''$ Angle Girder forming the end of the frame. Meccano Spring Buffers and Couplings are secured to each of the buffer beams in the positions indicated.

A $7\frac{1}{2}''$ Angle Girder 14 is bolted to the right-hand side of the main frame and to each of its ends a $1\frac{1}{2}''$ Strip is secured in a vertical position. Two $7\frac{1}{2}''$ Strips bolted to these complete the right-hand side tank. The left-hand tank 5 is constructed similarly, with the exception that $4\frac{1}{2}''$ and $2\frac{1}{2}''$ Girders are used in place of the $7\frac{1}{2}''$ Girder, so that an aperture is formed through which the winding key of the Clockwork Motor may be passed.

It will be seen that the rear portion of the tanks form part of the cab sides. To complete the cab, Angle Girders 16 (Fig. 3) are bolted to the Girders 14 and 15, and $2\frac{1}{2}''$ Strips are secured two holes further back, while $1\frac{1}{2}''$ Strips hold the Strips and Girders at the correct distance apart (see Fig. 1).

The Roof and Firebox

The roof is composed of four $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips and one $3\frac{1}{2}''$ Strip spaced by two $2\frac{1}{2}''$ large radius Curved Strips, one of which is bolted between the tops of the Girders 16 whilst the other is bolted across two 3" Angle Girders 17. The $3\frac{1}{2}''$ Strip in the centre of the roof is supported by Angle Brackets; this Strip is used instead of a Double Angle Strip so that advantage may be taken of the play in the securing bolts to obtain a slot through which may protrude the reversing lever 8 (Fig. 1) of the Clockwork Motor. Four 2" Strips form each side of the coal bunker and two Girder Brackets bolted to their ends form the rear, the space between these Girders being filled in by a 2" Strip.

The construction of the firebox may now be proceeded with. As will be seen from Fig. 1 the firebox top consists of two 3" Angle Girders 2 spaced apart by 2" Strips. Two 3" Strips are secured between the Girders and to these the Ross-Pop safety valve is secured. The valve consists of two outer "sleeves" removed from Meccano Spring Buffers, and these are held in place by means of Pivot Bolts.

Each side of the firebox consists of two horizontal 3" Strips

Parts required to build the Model 4–6–2 Tank Loco :

6	of No.	1b	2	of No.	10	25	of No. 38
5	" "	3	8	" "	12	5	" " 48b
7	" "	4	1	" "	12a	2	" " 50a
5	" "	5	2	" "	12b	25	" " 59
11	" "	6	4	" "	16	4	" " 62b
9	" "	6a	2	" "	16a	2	" " 64
2	" "	8	4	" "	17	3	" " 90
1	" "	8b	5	" "	18a	1	" " 103d
3	" "	9	6	" "	20	2	" " 103e
6	" "	9b	2	" "	24	2	" " 103f
4	" "	9c	1	" "	25	6	" " 109
2	" "	9d	156	" "	37	3	" " 111
3	" "	9e	8	" "	37a	1	" " 111a

1	of No.	111c
1	" "	115
6	" "	120a
2	" "	120b
2	" "	121
8	" "	136
6	" "	137
8	" "	147b
2	" "	161
1	" "	162a
2	" "	164
1	" "	166
1 Clockwork Motor		

secured at their ends to vertical $1\frac{1}{2}$" Strips which, in turn, are bolted to the sides of the Girders 2.

The firebox is held in position by means of an Angle Bracket bolted to the cab, and Flat Brackets secured to the Boiler 1. The Meccano Boiler is secured in position by bolts passed through the side tanks, and by two 2" Angle Girders bolted to Flat Girders that, in turn, are secured to the front of side frames of the locomotive.

Two Chimney Adapters are mounted on the Boiler, one being inverted to form the steam dome while the other represents the chimney. Handrail Supports are secured to the sides of the Boiler and carry Axle Rods which form the handrails. The smoke-box 4 is formed from two Boiler Ends held together by a $\frac{3}{4}$" Bolt passed through their centres.

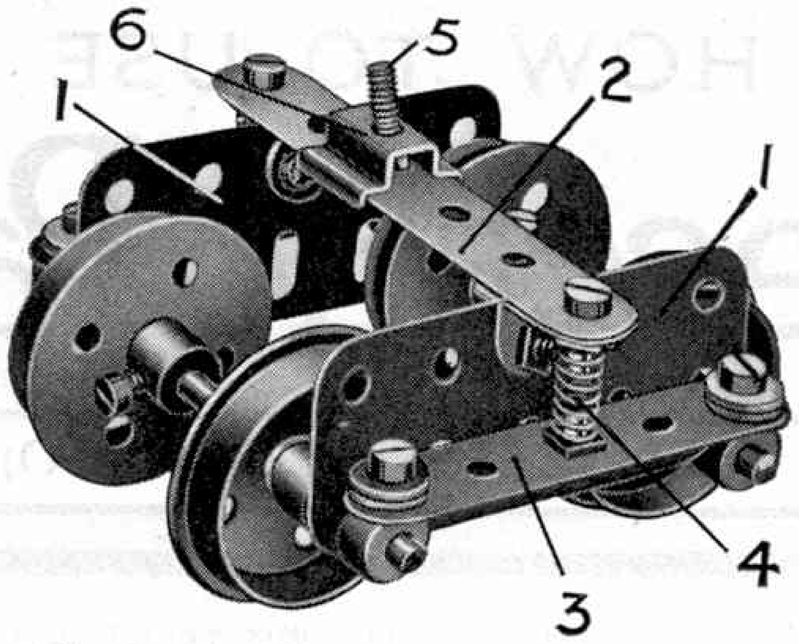


Fig. 2. The Front Bogie, showing springs and equalising beams

Assembly of the Power Unit

Fig. 4 shows the power unit. This consists of the Clockwork Motor, the drive being taken from the pinion on the driving shaft by a $\frac{3}{4}$" Pinion 12 on the Axle of the rear pair of driving wheels.

A $7\frac{1}{2}$" Strip is bolted to each side plate of the Motor to form a journal for the axle carrying the rear pair of driving wheels, and two $5\frac{1}{2}$" Angle Girders are also secured in position to give extra strength. Three $2\frac{1}{2}$" Rods carry the driving wheels, the front and rear pairs of which consist of Wheel Flanges bolted to Face Plates. The centre pair of Wheels are not provided with flanges, Bush Wheels being substituted for the Face Plates, thus allowing the loco to negotiate sharper curves than would otherwise be possible. The Motor is held in position by Axle Rods passed through the Double Arm Cranks 10 (Fig. 3) so that the reversing lever 8 (see Fig. 1) passes through the cab top. A $1\frac{1}{2}$" Strip is bolted to the brake lever and an End Bearing is connected pivotally to its extremity. This carries an Axle Rod which, after passing through a 1"×1" Angle Bracket secured to the coal bunker, is fitted with a Collar to form a control knob.

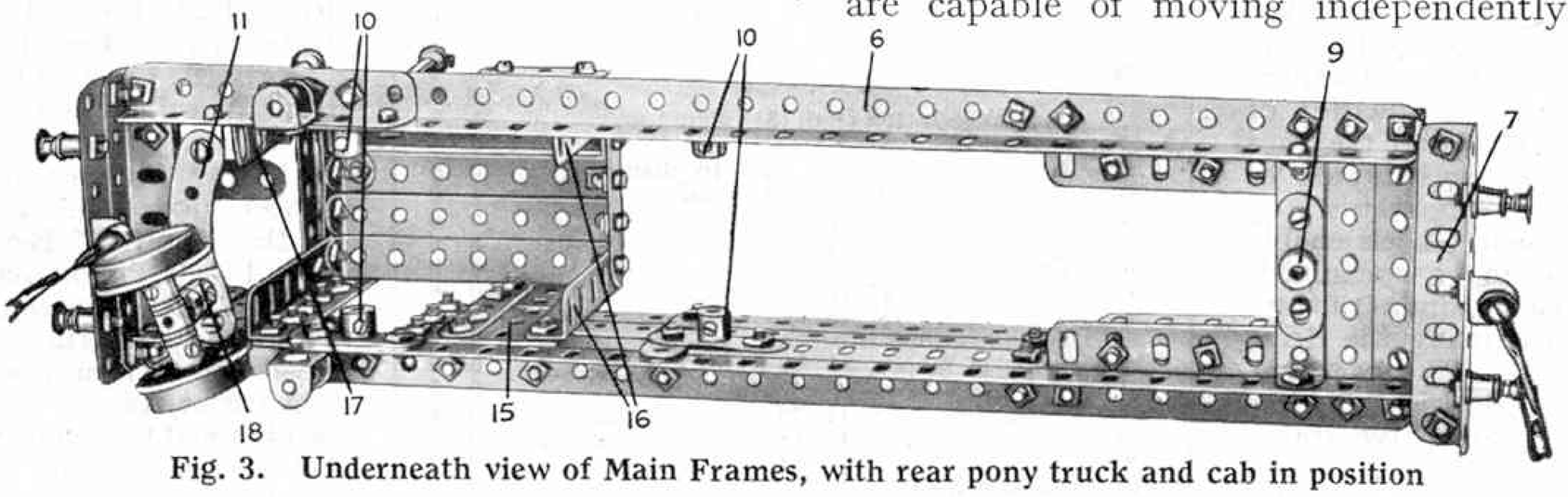


Fig. 3. Underneath view of Main Frames, with rear pony truck and cab in position

The rear pony truck can be seen in Figs. 1 and 3. It consists of two $1\frac{1}{8}$" Flanged Wheels mounted on a $1\frac{1}{2}$" Rod that is passed through a Collar. A Threaded Pin gripped in the tapped hole of this Collar is secured in the boss of an Eye Piece 18, which slides on the $2\frac{1}{2}$" Curved Strip 11 (Fig. 3) that is bolted to the side Girders 6 by Angle Brackets. The pony truck is spaced away from the Eye Piece by an extra Collar mounted on the Threaded Pin.

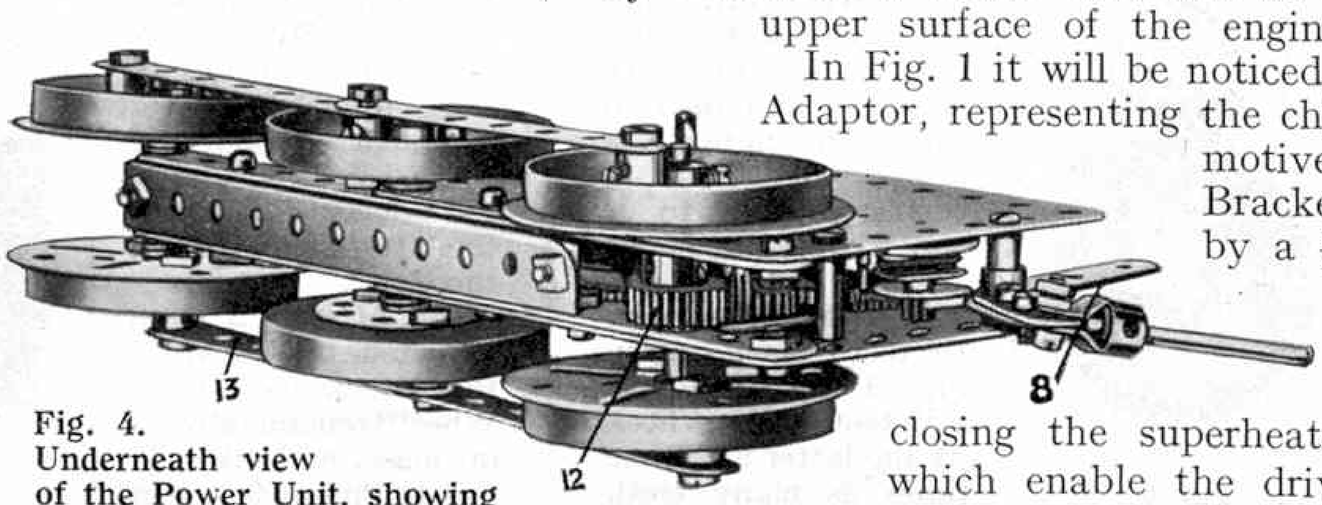


Fig. 4. Underneath view of the Power Unit, showing connecting rods, etc.

Bogie with Equalising Beams

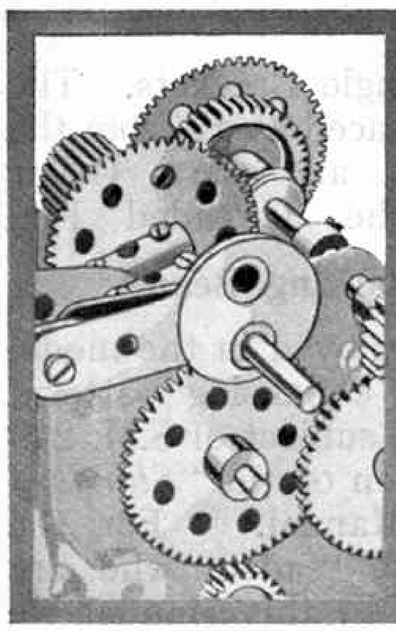
The bogie employed in the model is the standard equalising pattern, which forms the subject of S.M. 219 in the new edition of the "*Standard Mechanisms*" Manual. For the benefit of those readers who are unable to refer to this Manual we illustrate the bogie in Fig. 2.

Two $2\frac{1}{2}$" Flat Girders 1 are connected together by means of a 3" Strip 2 and Angle Brackets. The Axle Rods carrying the Flanged Wheels are passed through the elongated holes of the Flat Girders into Collars. The latter are secured together in pairs by $2\frac{1}{2}$" Strips 3, through the centre holes of which a bolt is passed and secured with its shank upwards. Compression Springs 4 are passed over these and also over the shanks of the bolts at each end of the Strip 2. The bogie is attached to the loco by means of the Eye Piece 6, which is connected pivotally to the Double Arm Crank 9 (Fig. 3). Owing to the arrangement of the Strips 3, which act as the equalising beams, the wheels are capable of moving independently in a vertical direction.

In the illustration, an old style Eye Piece without boss is shown, but the new pattern Eye Piece, which is of course fitted with a boss, should be used if available. If the old pattern is employed, this should be pivoted to the frame of the engine by means of a $\frac{3}{4}$" Bolt passed through the Eye Piece and into the boss of the Double Arm Crank 9, the Bolt being held rigidly in place in the boss of the Crank by means of its set-screw. A Collar should be placed upon this Bolt between the Eye Piece and the boss of the Double Arm Crank so that the bogie wheels will make contact with the rails when the completed model is placed upon the track.

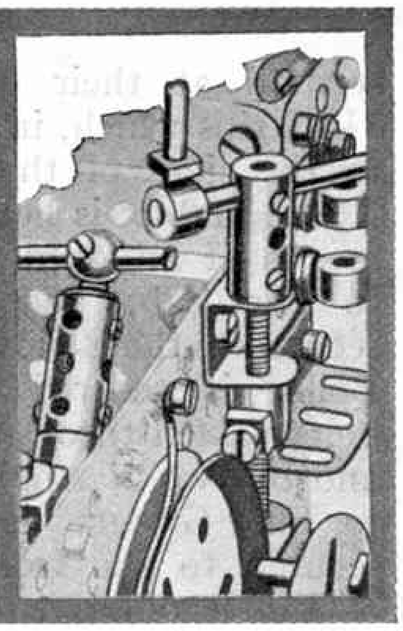
When using the new style Eye Piece a 1" Axle Rod serves as a bogie pivot. This Rod is held in the boss of the Eye Piece, is passed through the boss of the Double Arm Crank 9, and finally secured in place by means of a Collar that can be seen on the front upper surface of the engine frame (Fig. 1).

In Fig. 1 it will be noticed that the Chimney Adaptor, representing the chimney of the locomotive, is bolted to a Flat Bracket held to the Boiler by a $\frac{1}{2}$" Bolt. A Collar placed on this Bolt represents the casing enclosing the superheater shifting valves which enable the driver to release the vacuum in the superheater headers when coasting.



HOW TO USE Meccano Parts

VIII.—GEARS, etc. (CLASS O)



For the purpose o this series of articles we have grouped all the Meccano parts into two main sections, termed the Structural and Mechanical Sections, and these sections have been further divided into a number of separate classes. The complete grouping is as follows. Structural Section: Class A, Strips; Class B, Girders; Class C, Brackets, Trunnions, etc.; Class D, Plates, Boilers, etc.; Class E, Nuts and Bolts, Tools and Literature. Mechanical Section: Class M, Rods, Cranks and Couplings; Class N, Wheels, Pulleys, Bearings, etc.; Class O, Gears and Toothed Parts; Class P, Special Accessories; Class Q, Miscellaneous Mechanical Parts; Class T, Electrical Parts; Class X, Motors, Accumulators, etc.

THE Meccano parts included in Class O—namely, Gears, Pinions, Sprocket Wheels, Dog Clutches, and other toothed parts—are so important and their adaptations are so varied and numerous that it is impossible to deal with them all, however briefly, in the space available this month. Therefore we refer below to the Gear Wheels, Pinions, Contrates, Bevels, Worms, and Sprocket Gears only, and the remaining toothed parts included in this class will be dealt with next month.

The Meccano range of gear wheels is very comprehensive and enables almost any speed ratio to be obtained. The gears are manufactured from solid brass, with the exception of the 3½″ Gear Wheel and the Sprocket Wheels, which are of specially fine steel. The teeth are cut one at a time, not stamped out, and the precision of the finished parts is such that they are regularly used in the construction of all kinds of scientific apparatus.

The Pinions and Gear Wheels enable ordinary gear trains to be assembled, whilst the Bevel Gears and Contrate Wheels are for transmitting the drive through right angles. The Sprocket Wheels are of course designed for use in connection with chain drive transmission.

The published diameters of the various Meccano Pinions and Gear Wheels do not represent the overall measurements of the Gears, for they are measured from the "pitch line." This is an imaginary line that runs through approximately the centre of the teeth; it indicates the points on the teeth where the actual thrust is imparted from one gear to the other.

Parts in Class O: Gears and Toothed Parts

Part No.		Prices s.	d.
25	Pinion Wheels, ¾″ diam., ¼″ wide ... each	0	6
25a	" " ¾″ " ⅜″ " ... "	0	8
25b	" " ¾″ " ¾″ " ... "	0	10
26	" " ½″ " ¼″ " ... "	0	4
26a	" " ½″ " ½″ " ... "	0	6
26b	" " ½″ " ¾″ " ... "	0	8
27b	Gear Wheels 133-teeth (3½″ diam.) ... "	1	3
27a	" " 57 " (1½″ ") ... "	0	6
27	" " 50 " (1 5/16″ diam.) "	0	6
31	" " 38 " (1″ diam.) ... "	1	0
28	Contrate Wheels, 1½″ 50-teeth ... ... "	0	9
29	" " ¾″ 25 " ... ... "	0	6
30	Bevel Gears, ⅞″ 26-teeth ... ... "	0	9
30a	" " ½″ 16 " ... ... "	0	6
30c	" " 1½″ 48 " ... ... "	1	6
32	Worm, 12 threads per inch ... ... "	0	5
95b	Sprocket Wheels, 3″ 56-teeth ... ... "	0	6
95	" " 2″ 36 " ... ... "	0	5
95a	" " 1½″ 28 " ... ... "	0	4
96	" " 1″ 18 " ... ... "	0	3
96a	" " ¾″ 14 " ... ... "	0	3
110	Rack Strips 3½″ ... ... "	0	2
110a	" " 6½″ ... ... "	0	3
129	Rack Segments, 3″ diam. ... ... "	0	5
144	Dog Clutches ... ... "	0	6
147	Pawls, with Pivot Bolts and Nuts ... "	0	3
147a	Pawls ... ... "	0	2
148	Ratchet Wheels ... ... "	0	6
167a	Roller Races, geared, 192 teeth } see class N.		
167c	Pinions for Roller Bearings, 16-teeth } see class N.		
168b	Ball Races, geared, for Sprocket drive } see class N.		

In Fig. 2 a ¾″ Pinion is engaged with a 50-teeth Gear Wheel. Let us assume that the Rod upon which the Pinion is fixed is rotated at a speed of 60 revolutions per minute. The ¾″ Pinion has 25 teeth, and for every complete revolution that it makes it will cause the 50-teeth Gear Wheel to turn a distance occupied by 25 of its teeth, which is exactly one half of its circumference. Thus the 50-teeth Gear will turn only 30 revolutions per minute. The difference in speed obtained in this combination of Pinion and Gear is therefore as 2 to 1, and is written "ratio 2 : 1."

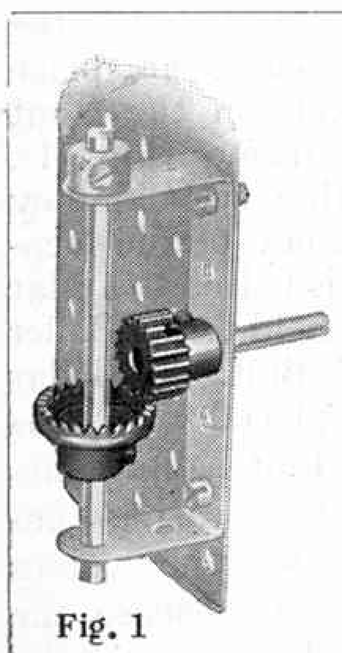


Fig. 1

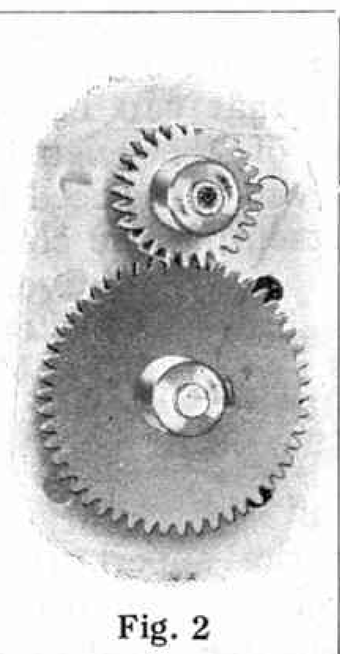


Fig. 2

A ½″ Pinion having 19 teeth is shown in Fig. 3 in mesh with a 57-teeth Gear Wheel. As the latter has three times as many teeth as the Pinion (and its pitch line diameter is three times as great), three revolutions of the Pinion are required for every complete revolution of the Gear Wheel. The ratio of this combination is therefore 3 : 1.

There are of course numerous other gear ratios obtainable, and the more usual ones are shown below, together with the alternative methods by which they may be produced. Meccano boys may find the list useful for reference purposes:—

Ratio 1 : 1 — two ½″ Pinions (axles ½″ between centres); two 1″ Gear Wheels (axles 1″ between centres); two 57-teeth Gear Wheels (axles 1½″ between centres); two ⅞″ Bevel Gears (see Fig. 4); ¾″ Pinion and ¾″ Contrate Wheel. Ratio 1.24 : 1 — ½″ Pinion and ¾″ Contrate Wheel (Fig. 1).

Ratio 2 : 1 — ¾″ Pinion and 50-teeth Gear Wheel (axles 1″ between centres); ¾″ Pinion and 1½″ Contrate Wheel. 3 : 1 — ½″ Pinion and 57-teeth Gear Wheel (axles 1″ between centres); ½″ Bevel and 1½″ Bevel.

7 : 1 — ½″ Pinion and 3½″ Gear Wheel (axles 2″ between centres). 19 : 1 — ½″ Pinion and Worm. 57 : 1 — 57-teeth Gear and Worm (see Fig. 7).

A variety of gear ratios may of course be obtained by connecting two Sprocket Wheels of varying diameter with a length of Sprocket Chain.

It will be observed from the accompanying price list that the ½″ and ¾″ diam. Pinions are each made in three widths, ¼″, ½″ and ¾″. The ¼″ width Pinion is for ordinary gearing, whilst the wider Pinions are specially designed for use in cases where the shaft on which a Pinion is secured is required to move longitudinally without disengaging the Pinion from its Gear Wheel. This movement is frequently required in Meccano gear boxes.

Fig. 10 shows how three different speeds may easily be obtained from a driving shaft with the aid of one intermediate shaft and a ½″ diam. ½″ width Pinion. Rod 1 is the driving shaft and carries the special Pinion. Rod 2 is the intermediate shaft, and Rod 3 is the driven shaft. Rod 2 may be moved longitudinally in its bearings by means of the sliding hand lever 4, which is connected to Rod 2 by means of the Couplings 5 and 6, the latter being free on the Rod 2. The movement of Rod 2 is so adjusted by Collars 7 that the 57-teeth Gear Wheel 8 remains always in mesh with the ½″ width Pinion 9. On sliding the lever 4, the

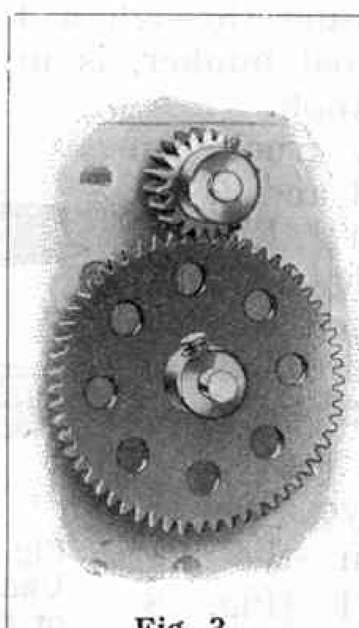


Fig. 3

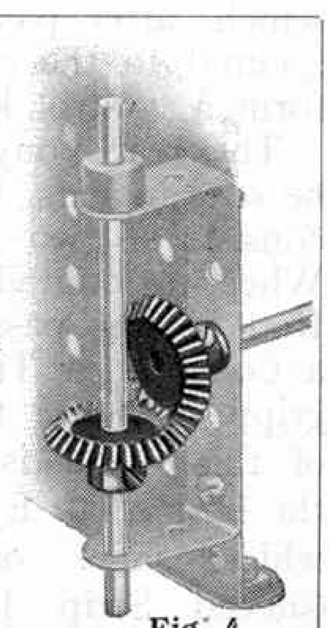


Fig. 4

drive may be transmitted to the Rod 3 either by way of (a) the Gear 8 and Pinion 10, (b) the 50-teeth Gear Wheel 11 and ¾″ Pinion 12, or (c) by the two 1″ Gears 13.

A further example of the adaptability of the ½″ width Pinion will be found in Fig. 6. In this case a ½″ diam. ½″ width Pinion 10 is connected by a Socket Coupling 9 to the male portion of a Dog Clutch 11. The unit so formed is free on the vertical Rod 3, but on operation of a lever which carries a bolt that engages with the groove of the Socket Coupling, it may be raised so that the Dog Clutch section is engaged with the female section 12 that is secured to the Rod 3. When out of engagement the sliding unit rests on the Collar 13. The Pinion 10 is in constant engagement with a Worm on the driving shaft; hence the Rod 3 may be thrown in or out of engagement when desired merely by moving the control lever up or down. The ½″ width Pinion is necessary because if an ordinary ¼″ width Pinion was used it would come out of engagement with the Worm as soon as the lever was raised.

Fig. 14 is another typical Meccano gear box, providing three speeds forward, neutral and reverse gears. This type of gear box is particularly adaptable to model motor cars. The Rod 64 forms the primary driving shaft and the drive is transmitted through the countershaft 71 to the driven shaft 78. The different speeds are obtained by sliding the Rod 71 longitudinally so that the drive is transmitted through different sets of gears. Reverse gear is obtained when the drive passes through the Gears 68, 72, 77, 83 and 81, the speed ratio between the driven shaft 78 and the driving Rod 64 being 1: 2. First speed forward is obtained when the following Gears are engaged: 68, 72, 75 and 79. This gives a ratio between shafts 78 and 64 of 1 : 4. In the second forward speed the drive is directed via 69, 73, 75 and 79 (ratio 1 : 2) and top forward speed is obtained through the Gears 69, 73, 76 and 80 (ratio 1 : 1). In a certain position of the countershaft 71, the only Gears in engagement are 68, 72, 81 and 83. This represents neutral gear, for the Pinion 83 and the countershaft revolve idly and no power is applied to the shaft 78.

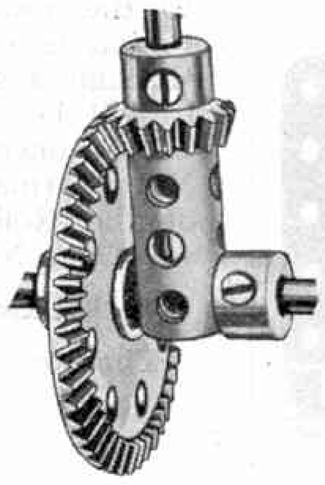


Fig. 5

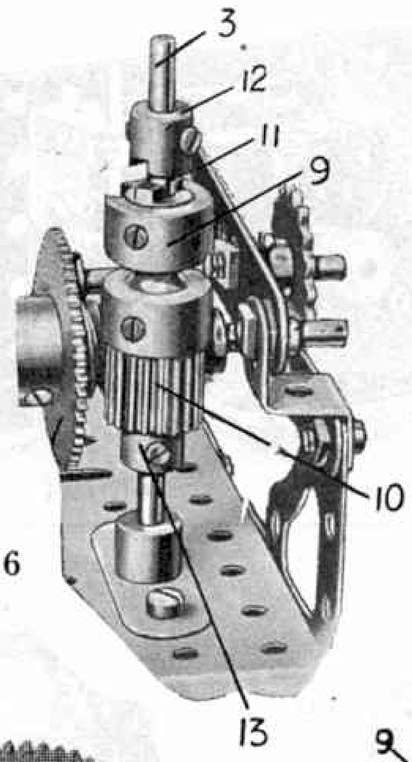


Fig. 6

Fig. 7

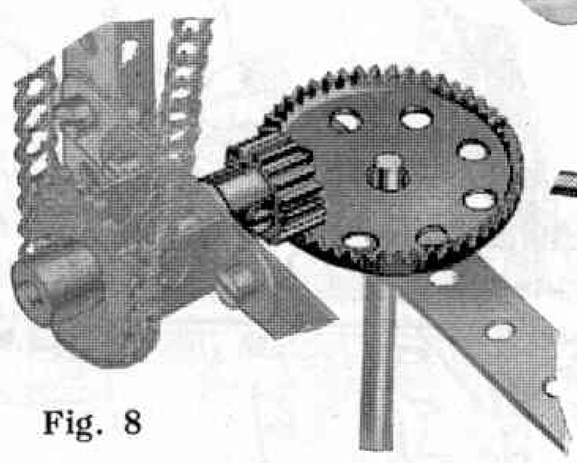


Fig. 8

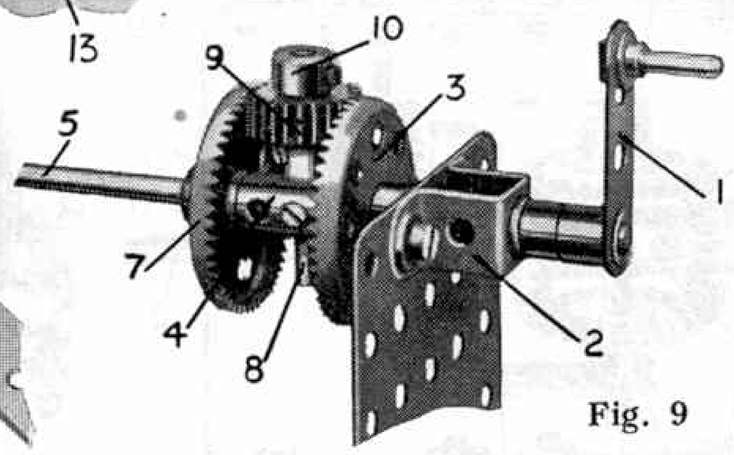


Fig. 9

Contrate and Bevel Gearing

The primary function of the Contrate Wheels (Nos. 27 and 28) is similar to that of the Bevel Gears, i.e., the transmission of driving power at right angles. A 3:1 right angle drive employing a ½″ Pinion and a 1½″ Contrate Wheel is shown in Fig. 8. In certain cases, however, they lend themselves to adaptations that are not possible with the Bevel Gears. For example, two Contrates of similar size mounted face to face on a common axis so that their teeth interlock will form a very efficient clutch unit, and one may be thrown in or out of gear with the other by a slight movement only.

When it is required to transmit a powerful drive at right angles it is preferable to use Bevel Gears rather than Contrate Wheels since in the former the teeth make contact over a greater area than in the Contrate Wheels. However, those Meccano boys who possess Contrate Wheels but no Bevels will find that they may employ the former in almost every case in place of Bevel Gears, with fairly good results.

In order to reduce friction to a minimum and to obtain a smooth even drive, bevel gearing is always designed so that the surfaces of the teeth of two bevels that mesh with each other lie in planes which, if extended, would all meet in a common point, and this point would coincide with the imaginary point of intersection of the axis of the shafts carrying the bevels. The Meccano Bevels are made with the teeth at such an angle that two ⅞″ Bevels may be meshed together or a ½″ Bevel may be engaged with a 1½″ Bevel. Two 1½″ Bevels should not be meshed together, nor should a ⅞″ Bevel be engaged with a 1½″ Bevel, for although such gearing would work, the teeth would not be properly in line and the arrangement would be bad engineering practice.

Fig. 12 should give a good idea of some of the more important adaptations of the Meccano Bevel Gears. It represents the differential gear incorporated in the Meccano Motor Chassis. The ½″ and 1½″ Bevel Gears are used to transmit the drive from the propeller shaft to the rear wheels, and the series of ⅞″ Bevels 5, 6, and 7 are arranged so that power may be applied to both road wheels under varying working conditions. Normally the Bevels 5, in rotating about the rear axle, carry the Bevels 6 and 7 bodily with them, but should one of the road wheels slow down or stop, as happens when the car turns a corner, etc., one of the Bevels 6 or 7 slows down and the Bevels 5 tend to travel round its teeth, thus causing the opposite Bevel to turn at a greater speed.

In Fig. 13 three ⅞″ Bevels are employed to form a simple and compact reversing gear. The driving power is applied to the shaft 2 and is directed via the ½″ diam. ½″ width Pinion 3 to the Gear Wheel 4, which is secured to the Rod 6 carrying two Bevel Gears 5. The reverse is effected by a hand lever connected to a rocking arm that causes the Rod 6 to move longitudinally in its bearings by striking one of the Collars secured against the faces of the Bevels 5. The direction of rotation of the driven Rod 10 is changed by bringing one or other of the Bevels 5 into engagement with the third Bevel, which is rigidly fastened to the Rod 10. The ½″ width Pinion 3 is used so that the Gear 4 may remain in gear with the driving shaft throughout the longitudinal movement of the Rod 6.

Another very useful adaptation of both Bevel and Contrate Gears is found in the assembly of reduction gearing between two shafts that are mounted in direct line with each other. A specimen gearing of this type, in which Contrates are employed, is shown in Fig. 9. The handle 1 is secured to a 2″ Axle Rod that is journalled in the bearings 2. This Rod is free to rotate in the boss of a 1½″ Contrate Wheel 3, but is secured in one end of the Coupling 4. A further Rod 5, which runs freely in the other end of the Coupling 4, carries the 1½″ Contrate Wheel 7 fixed in the position shown.

A 1½″ Rod 8 gripped in the central transverse hole of the Coupling 4 carries a ¾″ Pinion 9, which is free to rotate about the Rod but is retained in position by a Collar 10. The Pinion is engaged by the teeth of both Contrate Wheels 3 and 7. The Double Bent Strip forming the bearing 2 for the driving Rod is bolted to the Plate

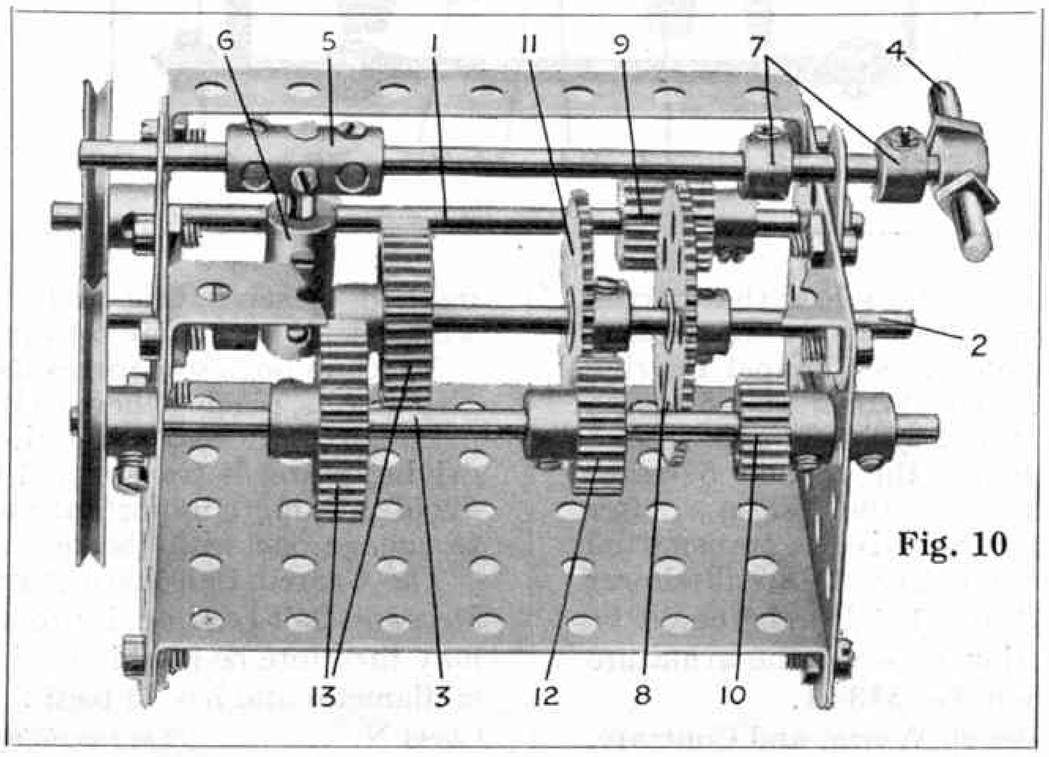


Fig. 10

by two $\frac{1}{2}$" Bolts, the shanks of which enter holes in the Contrate Wheel 3 and so prevent the latter from rotating.

It will be found that the secondary shaft 5 rotates twice as fast as the driving Rod carrying the handle 1. Alternatively, by using the Rod 5 as the driving shaft, a 1 : 2 reduction gear will be obtained, for the 2" Rod will revolve once only to every two revolutions of the Rod 5. By repeating the device two or three times in a straight line, a very compact transmission gear may be obtained.

The Meccano Worm has a pitch of twelve threads to the inch, to enable it to mesh properly with the various Meccano Gears. It is extremely useful for speed reducing purposes, although it should be remembered that it absorbs a good deal of power, owing to friction created by the thrust that is produced through the tendency of the Worm to move longitudinally instead of turning the Gear Wheel. A Worm drive should always be kept thoroughly lubricated.

Owing to the fineness of the pitch the Meccano Worm is irreversible, that is, it cannot be rotated from a Gear Wheel but can only be used to impart motion to the Gear Wheel. This irreversibility of the Worm sometimes proves a great advantage. For example, if a Worm drive is applied to the winding drum of a hoisting gear, the load will remain suspended in any position after the power is withdrawn, and there is no danger of the load over-running.

Each revolution of a Worm results in the Gear Wheel with which it meshes moving through a distance equal to one of its teeth. Hence the number of revolutions that must be made by a Worm in order to complete one revolution of the Gear Wheel or Pinion which it drives, can be ascertained by counting the teeth on the driven wheel.

An idea of the value of the Meccano Worm in speed reduction mechanisms will be obtained when it is remembered that a ratio of 3249 : 1 may be obtained merely by duplicating the gearing shown in Fig. 7, the second Worm being secured to the shaft of the Gear Wheel that is driven by the first Worm.

Fig. 11 is included as a typical example of Meccano reduction gearing. It will be seen that a Worm mounted on the armature shaft of the Electric Motor engages with a 57-teeth Gear which is mounted on a short Rod that carries a $\frac{1}{2}$" Pinion engaging with another 57-teeth Gear on another short Rod. Both these Rods are journalled in a Channel Bearing bolted to the side plate of the Motor. The Worm and 57-teeth Gear provide a ratio of 57 : 1, while the $\frac{1}{2}$" Pinion and second 57-teeth Gear produce a 3 : 1 ratio; hence the second 57-teeth Gear turns only once in 171 revolutions of the Worm. After the speed has been reduced in this way the drive is transmitted to a vertical shaft through a 1 : 1 Bevel Gear. If a still slower speed is required a 3 : 1 Bevel drive ($\frac{1}{2}$" and 1$\frac{1}{2}$" Bevels) could be used at this point, and the total reduction between the armature shaft and the vertical Rod would then be 513 : 1.

In all types of right angle drive, i.e., Bevel, Worm, and Contrate, particular care should be paid to the bearings, since considerable torque is set up in the shafts. The bearings should be placed as close to the Gears as possible, and if practicable they should be on either side of each Gear. Such bearings may often be provided with the help of a Coupling mounted as in Fig. 5.

When designing Meccano gearing it should be remembered that the Roller Race of the Geared Roller Bearing unit may be used as a large gear wheel. It is 12" in diameter and has 192 teeth. It engages with the special 16-teeth Pinion (part No. 167c) and provides a speed ratio of 12 : 1, the axles carrying the two parts being placed 6$\frac{1}{2}$" between centres. The Meccano Roundabout (Special Instruction Leaflet No. 8) is rotated by a 16-teeth Pinion meshing with a Geared Roller Race that is secured to the rotating structure, and since the Pinion is driven from an Electric Motor through a gear train identical to Fig. 11, it will be seen that the Roundabout revolves once in 2,052 revolutions of the Motor armature. For further particulars of the Roller Race and 16-teeth Pinion see Class N., dealt with last month.

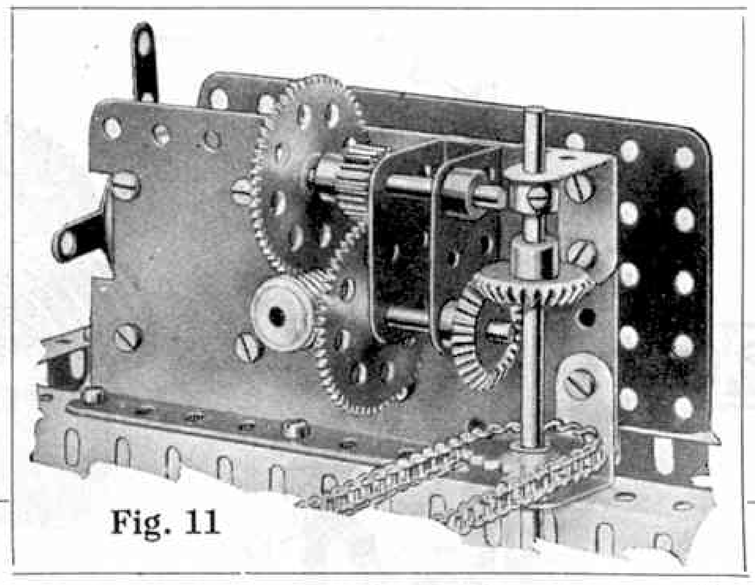


Fig. 11

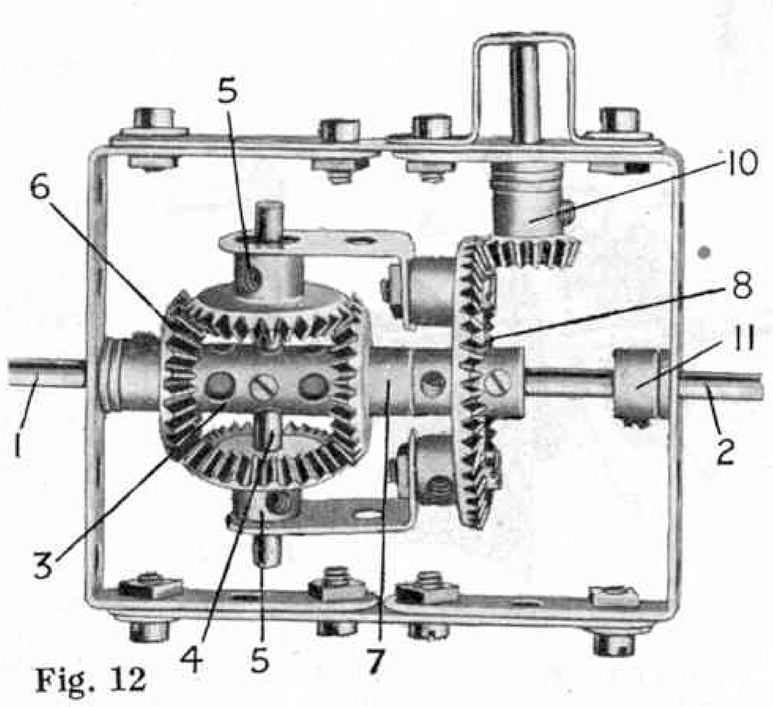


Fig. 12

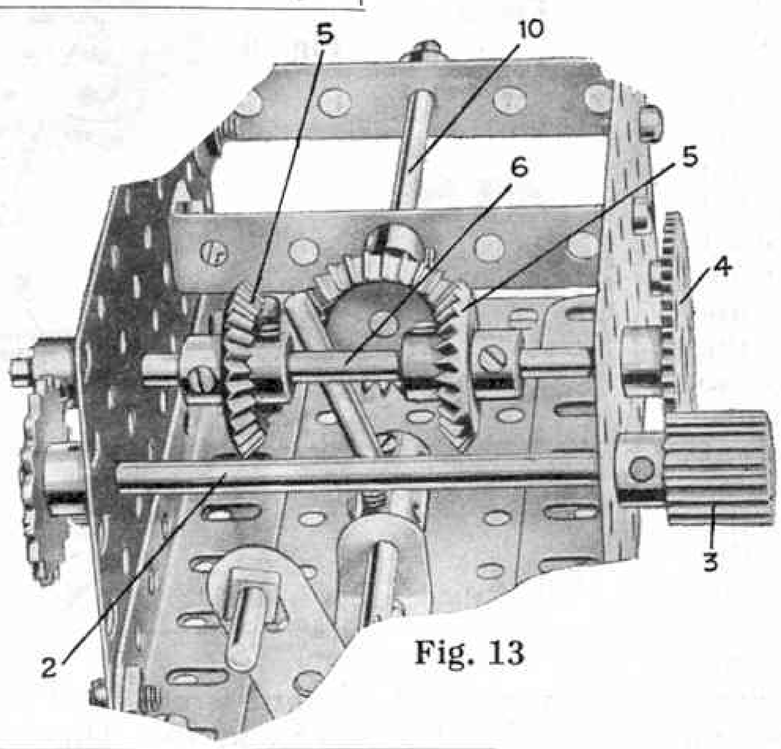
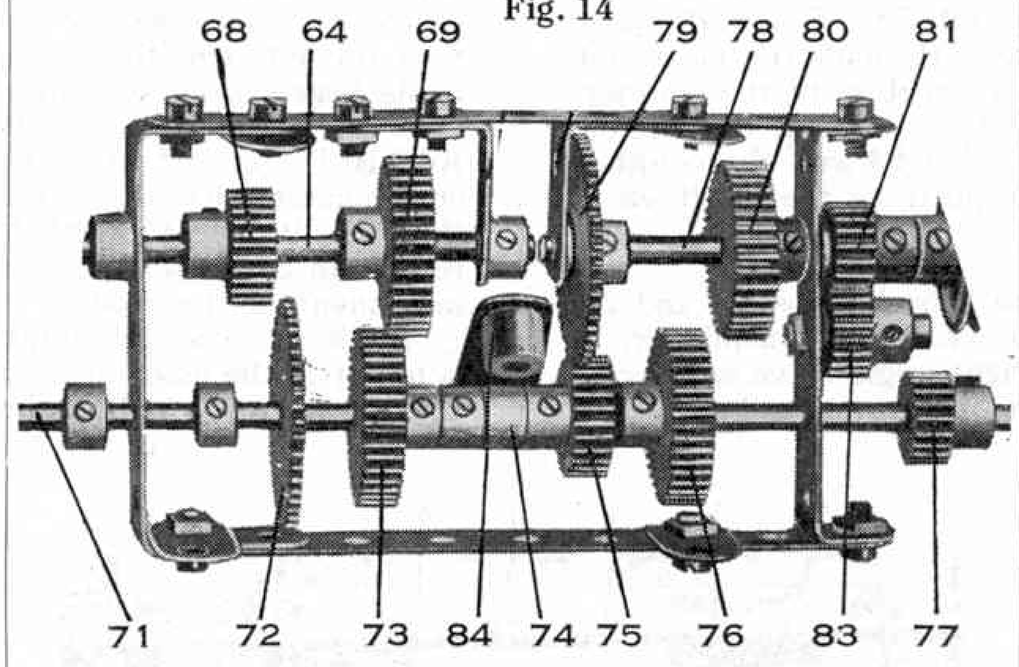


Fig. 13

Fig. 14



Sprocket Gearing

The Meccano Sprocket Wheels and Chain provide an invaluable method for transmitting motion between two shafts where the distance is too great to enable gears to be used conveniently, and where a belt drive would not be sufficiently positive. There are five sizes of Sprocket Wheels, and the following are a few of the many different speed ratios that may be obtained with their aid. Certain of the figures shown are approximate only; the exact ratios can be ascertained by dividing the number of teeth on the smaller wheel into the number of teeth on the larger wheel.

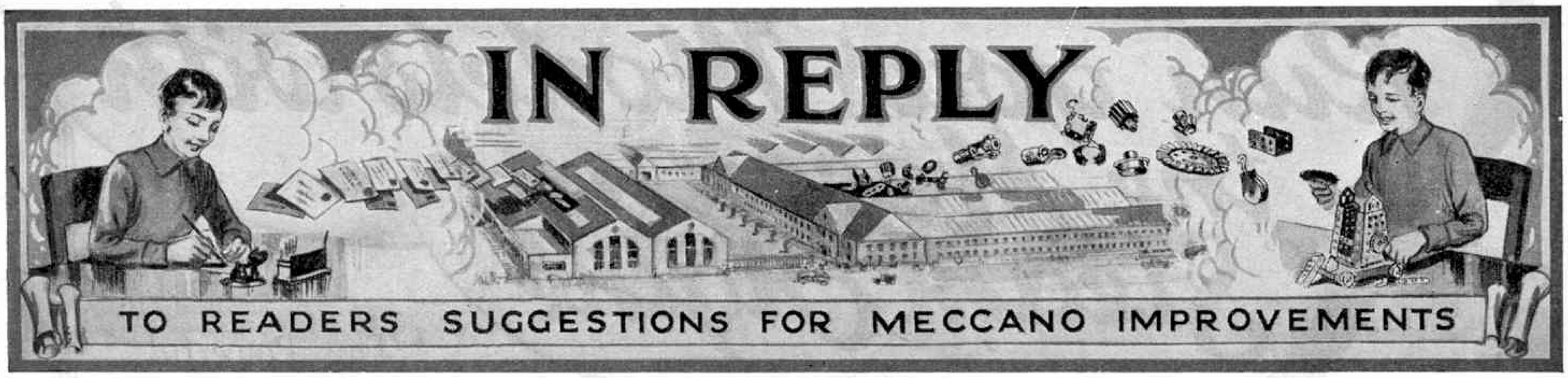
Ratio 4 : 1 — $\frac{3}{4}$" and 3" diam. Sprocket Wheels. Ratio 3 : 1 — 1" and 3" diam. Sprocket Wheels. Ratio 2 : 1 — $\frac{3}{4}$" and 1$\frac{1}{2}$" diam. Sprocket Wheels. Ratio 1$\frac{1}{3}$: 1 — 1$\frac{1}{2}$" and 2" diam. Sprocket Wheels.

Ratios of 1 : 1 may, of course, be obtained by using any two Sprocket Wheels of like diameter.

The great advantage of Sprocket gearing is that power may be transmitted through almost any distance with very little loss through friction. Conveyors and caterpillar track, etc., may also be built up with its aid. The method of separating and connecting lengths of Sprocket Chain will be dealt with more fully in Class P, in which this part is included.

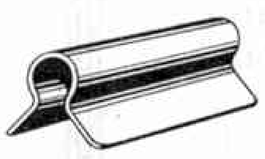
Meccano boys sometimes use their Sprocket Wheels like ordinary gear wheels, placing them so that their teeth engage. This practice is permissible in the construction of simple models where only a light driving power is transmitted through the gearing, but it should be avoided in more important models, since the teeth are not designed to engage one with the other as in ordinary spur gearing.

The Geared Ball Race (part No. 168b), which forms part of the Meccano Ball Bearing, is provided with standard sprocket teeth, and may therefore be used in chain driving mechanisms. It measures 4" in diameter and has 73 teeth. For further particulars of this part see Class N. *(The remaining parts in Class O will be dealt with next month).*



In this page, month by month, we reply to suggestions regarding improvements or additions to the Meccano system. We receive many hundreds of these suggestions every week, and consequently we are able to publish only ideas that show particular interest or ingenuity. Suggestions submitted for consideration in this section must be written on a separate sheet of paper and the name and address of the sender must appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Old Swan, Liverpool.

NEW SPRING CLIP.—There are certainly possibilities in your idea for a spring clip of extra length. The accompanying sketch shows that the clip would provide considerable bearing surface for one or more Rods placed in it, the coupling thus formed possessing the advantage that both rods would be in almost perfect alignment. The clip would, however, be useless if any great torque had to be transmitted from one rod to the other, and for this reason we doubt whether we would be justified in adding the part to the system. We are, however, giving the idea careful thought. (*Reply to J. Bonell, London S.E.23*).



SPECIAL SPRING.—We note your suggestion that a length of special spring should be introduced for suspending the pendulum of the Meccano Clock. We consider, however, that the introduction of such a spring is unnecessary as this article can easily be obtained locally. A 1½" length of very thin spring brass approximately ¼" wide is all that is required. (*Reply to F. Disradge, Langley, Birmingham*).

IMPROVED GEAR WHEEL.—There would be little advantage to be gained from punching series of holes around the periphery of the 3½" Gear Wheel. Actually it is only occasionally necessary to bolt or pivot other accessories to this wheel, and in these cases the existing perforations will be found adequate. (*Reply to L. Ison, Northcote, Victoria, Australia*).

TRACTOR WHEELS.—Your idea that special wheels having flat rims fitted with a number of skew blades, should be introduced for use in model tractors, etc., is distinctly interesting. The present method of representing the large wheels of a tractor with standard Meccano parts, is to bolt two Hub Discs back to back and to secure a number of bolts in the holes and slots round the circumference to provide the necessary "grip," as, for example, in the Meccano Traction Engine (Super Model No. 22). However, there is no reason why, with a little ingenuity, Flat Brackets or 1½" Strips should not be arranged to represent the skew blades, and we shall be pleased to hear from any readers who have succeeded in doing this. (*Reply to W. Berry, Darwen*).

GIRDER CORNER PIECE.—A corner piece of similar section to the standard Meccano Angle Girders, would no doubt be useful in certain types of structural work. The manufacture of this part would, however, necessitate a rather complicated bending operation, which would prevent the article being produced economically. We shall not lose sight of the idea, however, as its utility is quite evident. (*Reply to J. M. R. Murdock, Eastbourne*).

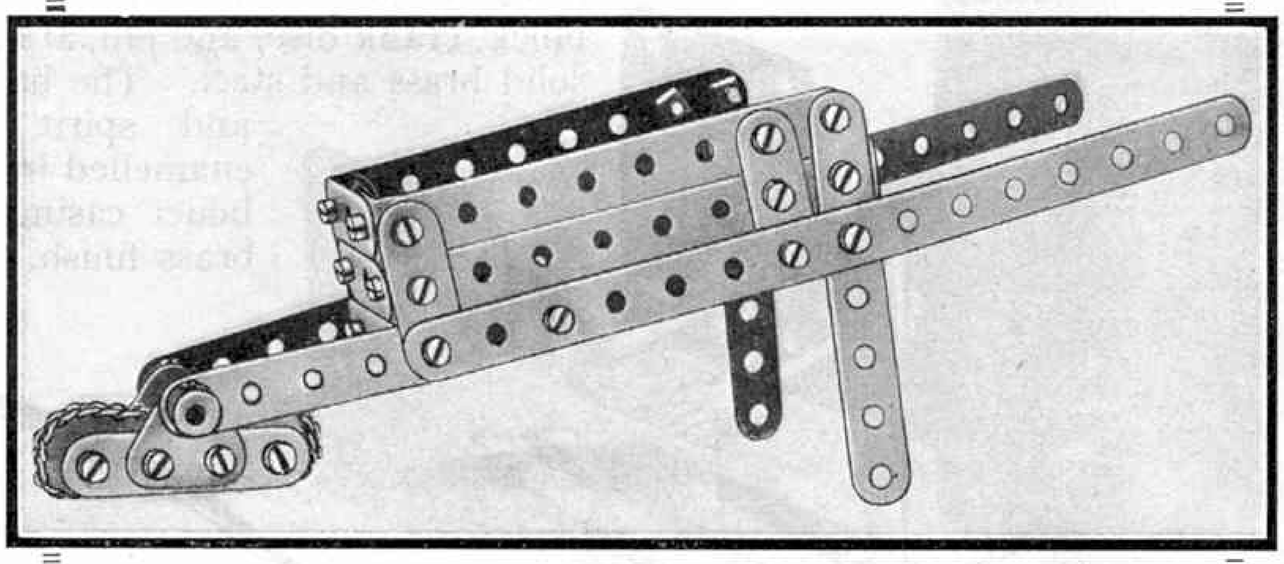
FLEXIBLE COUPLING.—The "Bowden wire" type of coupling can be represented by Spring Cord, but if you mean something in the nature of a universal coupling, we would say that the system already includes a part (No. 140) of this description. (*Reply to N. S. Thomas, Wallasey*).

BALL AND SOCKET JOINT.—A joint is already available in a somewhat similar form to that which you propose, for the existing Universal Coupling will be found to answer practically all requirements where a ball and socket joint would be useful. It is possible also to build up a quite satisfactory ball and socket unit and an illustration of this is to be found in the Meccano model of Siemens Chronometric Governor (which is fully described in the 1929 Book of New Models, and also on page 426 of the May 1928 issue of the "*M.M.*"). (*Reply to L. Baker, Southampton*).

SPRING STEEL STRIP.—As previously pointed out in these pages, the existing Meccano Strips fulfil the functions of automobile springs quite well, and there is therefore no need for special tempered steel springs to be supplied. (*Reply to M. Plummer, Guernsey, C.I.*).

PERMANENT MAGNET MOTOR.—We are not thinking of introducing a permanent magnet electric motor into the Meccano system at the present moment, although such a motor could be fitted to model engines. The permanent magnet type of motor is expensive to produce and its only advantage over the electro-magnetic type is that it can be reversed at a distance by two wires, while four leads are of course needed to reverse the armature of the electro-magnet type. This advantage, although obvious in the case of a miniature railway layout, would not be readily appreciated in Meccano constructional work, and the innovation would not therefore be justified. (*Reply to R. McCreath, Burton-on-Trent*).

Caterpillar (Track) Aids the Gardener!



The caterpillar and the gardener have ever been at war, but from the latest reports it would appear that the gardener has "scored a point" over the caterpillar, for he now makes use of a garden barrow fitted with the caterpillar's method of locomotion expressed in mechanical form! The new idea is illustrated in this Meccano model, which represents a garden barrow fitted with a small "caterpillar track motion." In the actual device, the hinged plates from which the track is formed adjust themselves to the contour of the roughest ground, and enable the barrow to be wheeled over ruts and stones with a minimum effort. The Meccano model was built by T. Sergeant, of Triangle, Yorks., who secured one of the principal awards in Section A of the "October" Model-building Competition, the results of which were announced in the July "M.M."

IMPROVED CLOCKWORK MOTOR.—Your suggested improvement to the existing Clockwork Motor is quite interesting and no doubt smoother running would result if a triple spring were fitted. It must be remembered, however, that the cost of fitting three springs prohibits the use of what is otherwise a good suggestion. (*Reply to F. Fearnley, Prenton, Birkenhead*).

PISTON AND CONNECTING RODS.—While the flattening and drilling of one end of ordinary Axle Rods would certainly provide an excellent means of pivotally connecting two Rods together to form piston and connecting rods for model locomotives and other engines, such a part would be strictly limited in adaptability and would not therefore be a suitable addition to the Meccano system. (*Reply to L. M. Lea, London, N.W.2*).

GEARBOX FOR CLOCKWORK MOTOR.—We are of the opinion that your suggestion regarding the fitting of a gear box into the standard Clockwork Motor would add considerably to the cost of the Motor. This is not the only disadvantage however, as internal gears would deprive boys of the interesting task of designing and constructing gear boxes to meet their individual requirements. (*Reply to D. Lewis, Walton-on-Thames*).

ARC CARBONS.—"Soft core" carbon rods of such a size that they could be slipped into the bores of Meccano Couplings, etc., thus enabling an arc lamp to be built up, would form an interesting addition to the system. The carbons would not be very economical in use, however, as being so small in diameter they would burn away very rapidly. It is questionable also whether arc lamp apparatus could be devised from Meccano parts with an adequate degree of safety, for the method of electrical insulation at present employed is intended only for low voltage supply, and were the high voltage and current necessitated in the use of the voltaic arc employed, it would be necessary to provide further protection. We intend giving the entire question our very careful attention at an early date. (*Reply to R. P. Beaumont, Newcastle-on-Tyne*).

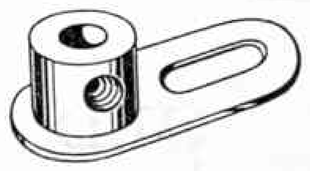
CYLINDER ASSEMBLY.—We note that you consider a special manufactured cylinder complete with piston and piston rod, a suitable addition to the system. We would remind you, however, that with the aid of the Meccano Sleeve Piece and two ¾" Flanged Wheels an excellent cylinder can be built up. A suitable piston for fitting in this cylinder may be formed from a ½" fast Pulley Wheel secured upon an Axle Rod of the required length. (*Reply to H. Seaborn, Manningtree*).

MOTOR FITTINGS.—Like other fittings specially designed for model cars (i.e., windscreens, mudguards, etc.), miniature traffic mirrors would be unsuitable parts for introduction to the system. Those model motor enthusiasts who are particularly anxious to include mirrors on their cars should obtain an old inspection mirror as used by dentists, as this will be found just the right size for most models, and will function excellently. The handle of the mirror should be cut down, leaving about 2" which may be bent round to form a loop or eye for fixing purposes. Meccano boys will agree that when used in this way the mirror is performing a far more pleasant function than when employed in ascertaining which of the unfortunate patient's molars are in need of attention from the dental forceps! (*Reply to R. Johnston and V. Knight, Southampton*).

SINGLE TOOTH WHEEL.—There is no necessity for us to introduce a one tooth Gear Wheel, as the Meccano Centre Fork (part No. 65) when mounted in a Coupling fulfils the functions of your suggested part equally well. (*Reply to C. M. Lording, Keilon, Australia*).

3" CIRCULAR PLATE.—The introduction of a Circular Plate of this diameter is under consideration and a definite decision has not yet been reached. (*Reply to R. Sutton, Nottingham*).

NEW CRANK.—Your suggested crank fitted with a ½" web, similar to the sketch, is interesting. The part would no doubt be useful in building up the crankshaft of a small model engine where space is at a premium. We are of the opinion, however, that the Meccano Double Arm Crank (part No. 62b), although perhaps not quite as compact as your suggested article, possesses several distinct advantages over the latter. In a model steam engine, for instance, the slotted arm may be used as the crank web, while the other arm may be suitably weighted, thus enabling a balanced crank to be reproduced. Many other uses can be found for part No. 62b which could not be fulfilled by your suggested article. (*Reply to G. Fryer, Eastbourne*).



Run your Models with the Meccano Steam Engine

Height 7 ins.
Length 7 ins.
Width $4\frac{1}{4}$ ins.

This Powerful Engine is specially designed to build into Meccano Models

You have already experienced the thrill of building real engineering models with Meccano . . . imagine the crowning joy of operating your models with the Meccano Steam Engine, in exactly the same way as their "big brothers" are worked in real life!

The powerful Meccano Steam Engine, which is fitted with reversing gear, is the latest Meccano achievement. The base and side plates are pierced with the standard Meccano equidistant holes, thus enabling it to be built into any Meccano model in the exact position required.

Steam is admitted to a single cylinder of the oscillating type through a special reversing block. Operation of the reversing lever enables the crankshaft to run in either direction.

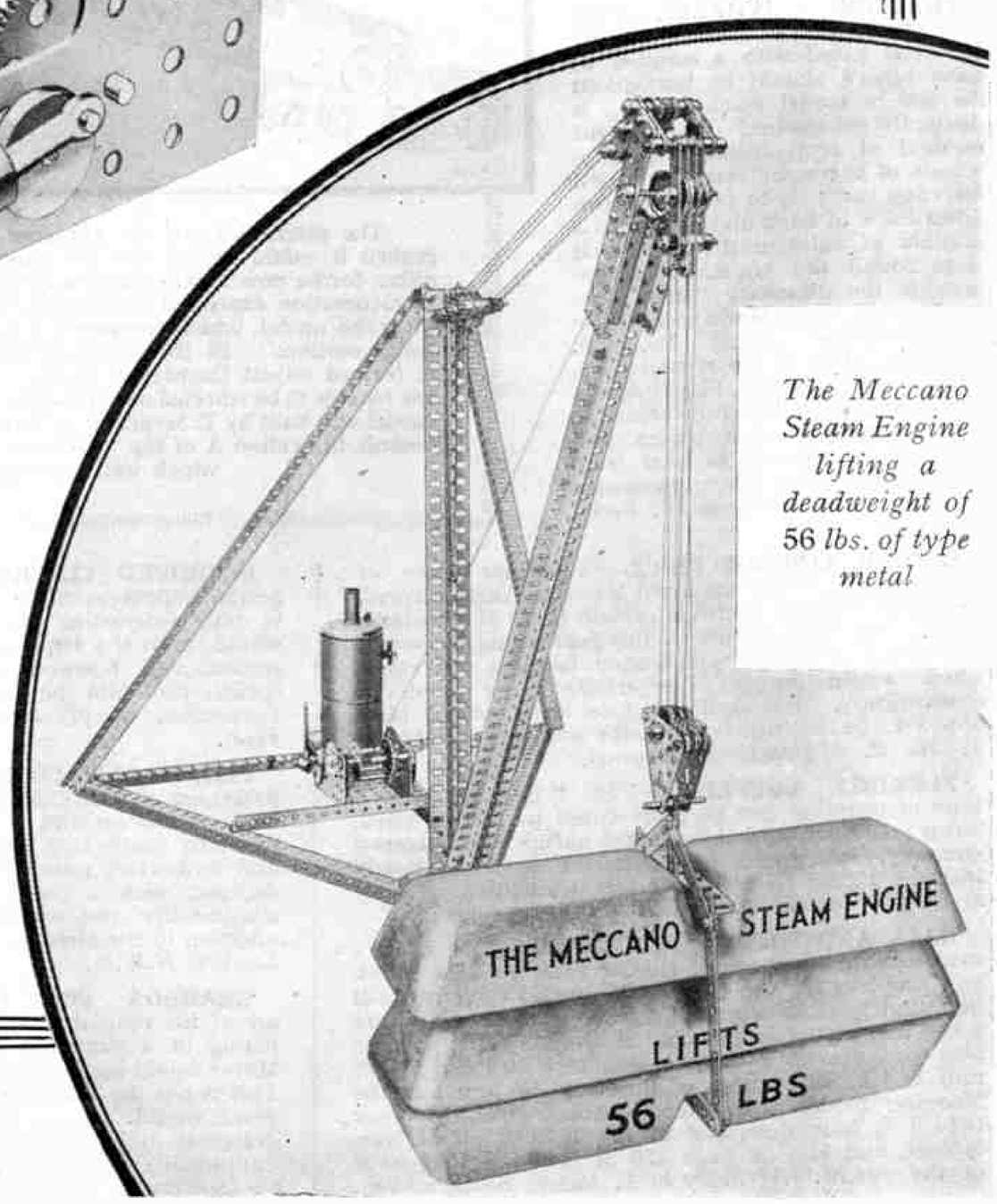
The boiler is of heavy gauge brass and is fitted with an efficient safety valve. The cylinder, reversing block, crank disc, and pin, are machined from solid brass and steel. The base, side plates, and spirit container are enamelled in colour and the boiler casing is of oxidised brass finish.

Price 21/-

As will be observed, the spirit container for the lamp is placed well outside the boiler casing, eliminating all risk of the spirit becoming heated.

When suitably geared the Meccano Steam Engine is capable of developing remarkable power. On actual test it has lifted over 56 lbs.

A special Manual, containing full instructions for operating the Meccano Steam Engine and showing 31 Meccano models in which the engine is incorporated, is supplied with each engine.



The Meccano Steam Engine lifting a deadweight of 56 lbs. of type metal

MECCANO LTD.
OLD SWAN — LIVERPOOL

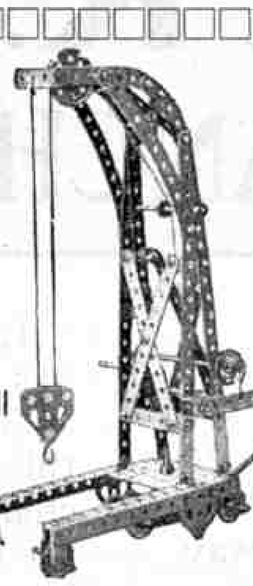
Grand Autumn Model-Building Contest

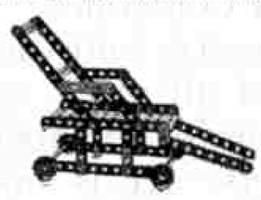
THE lengthening autumn evenings induce boys to start model-building in earnest. Consequently we are announcing this month one of the most important model-building contests organised in connection with the "*M.M.*" this year.

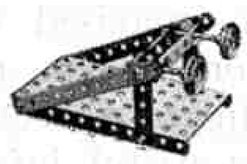
Prizes in this contest will be awarded for originality of ideas, as expressed by the novelty of the subject chosen for the model, or in the manner in which the various Meccano parts are used.

Any type of model may be entered, so the competitor is at liberty to give full rein to his own ingenuity and imagination. Any size of Outfit or quantity of parts may be used, although it should be remembered that it is not necessarily the most elaborate and intricate models that will carry off the prizes, and there are no entrance fees or forms. Every boy stands an equal chance of securing the biggest prize.

Readers should send in clear photographs or good drawings of their models together with a brief explanation of any intricate mechanism or interesting detail of construction that may be present. Actual models must not be sent. Photographs or drawings of prize-winning models become the property of Meccano Ltd. Neither photographs nor drawings need be the competitor's own work, but it is essential that the model itself is his own unaided work, both in design and construction.







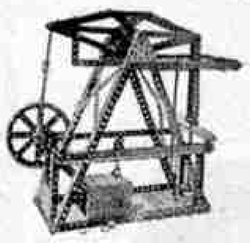
List of Prizes

The Prizes to be awarded in Sections A and C are as follows:—

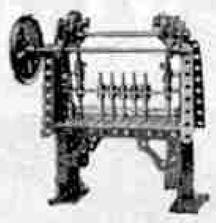
First Prize: Cheque for three guineas.
Second Prize: Cheque for two guineas.
Third Prize: Cheque for one guinea.
Six Prizes, each consisting of Meccano products to the value of 10/6.
Twelve Prizes, each consisting of Meccano products to value 5/–.

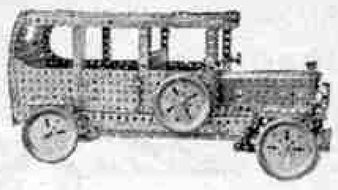
The Prizes in Section B are as follows:—

First Prize, Meccano products to value two guineas.
Second Prize, Meccano products to value one guinea.
Third Prize, Meccano products to value 10/6.
Six Prizes, each consisting of Meccano products to value 5/–.



A limited number of Certificates of Merit and Consolation Prizes will be awarded in each Section.





The competition is divided into three Sections, as follows: Section "A" for readers residing in the British Isles and over 14 years of age; Section "B" for readers residing in the British Isles and under 14 years of age; Section "C" for readers of all ages residing Overseas. Although the Overseas entries will be grouped together in one section, the age of each competitor will be taken into consideration when judging.

The competitor's name and address must appear on the back of each photograph submitted or sheet of paper used, together with the age, name of the competition ("Autumn") and the Section (A, B, or C) in which the model is entered.

Envelopes are to be addressed to "Autumn" Model-building Competition, Meccano Ltd., Binns Road, Old Swan, Liverpool. Entries for Sections "A" and "B" must be received not later than 31st October, 1929. Closing date for Section C is extended to 31st January, 1930.

RESULT OF FIRST "LYNX-EYE" CONTEST (OVERSEAS SECTION)

This month we are able to announce the list of prize-winners in the "Overseas" Section of the First "Lynx-Eye" Contest. As was the case in the "Home" Section, a very large number of entries was received, and examination of these proved that Meccano boys residing overseas are not a whit less keen or sharp-eyed than their fellow Meccanoites at home. It will be remembered that in the competition announcement it was mentioned that, should more than one correct solution be submitted, the prizes would be awarded to those entries first examined by the judges. As a matter of fact a great many boys succeeded in solving correctly all the pictures, so this plan had to be adopted.

For the benefit of overseas boys who are unable at the moment to refer to the solution to the pictures, which appeared in the June "*M.M.*" in connection with the "Home" Section results, we repeat it this month. Below will be found the Manual numbers of the models from which the fragmentary illustrations were obtained. The model numbers are those found in the 1929 Manuals.

Fig. 1, Model No. 4.51 (Fig. 4.51a); Fig. 2, Model No. 4.38; Fig. 3, Model No. 0.25; Fig. 4, Model No. 1.161; Fig. 5, Model No. 6.34 (Fig. 6.34a); Fig. 6, Model No. 4.53; Fig. 7, Model No. 4.33; Fig. 8, Model No. 3.12; Fig. 9, Model No. 00.4; Fig. 10, Model No. 1.43; Fig. 11, Model No. 3.51; Fig. 12, Model No. 7.21.

The following competitors secured prizes:—

First Prize (Meccano Products to value £1-1s.-0d.): H. Wicke, Sydney, Australia. Second Prize (Meccano Products to value 15/–): D. Grieve, Bloemfontein, South Africa. Third Prize (Meccano Products to value 10/6): A. Rodriguez, Montreal, Canada.

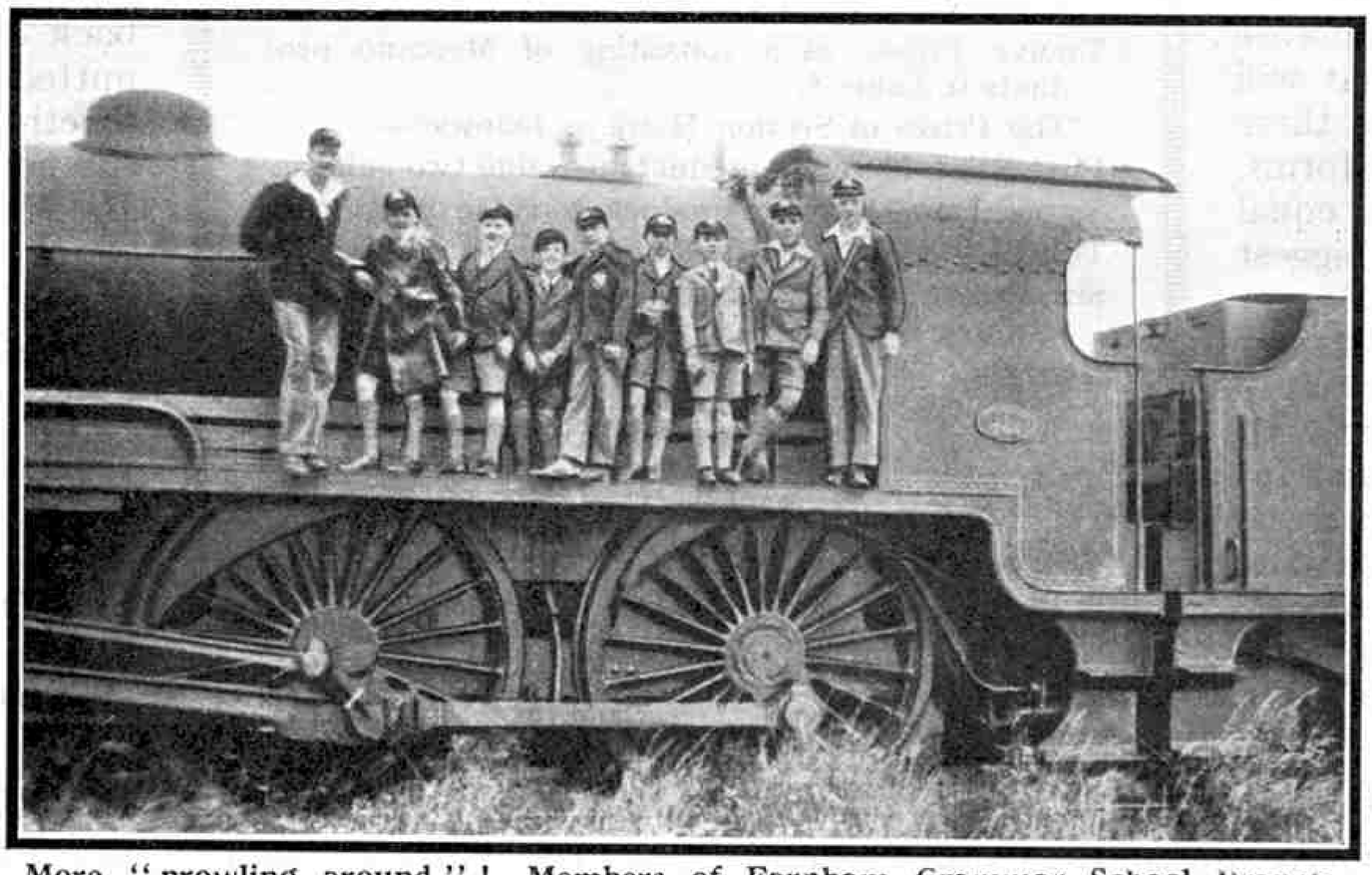
Twelve copies of "Famous Trains":—Miss C. Gonsalves, Bombay; J. Tanner, Sydney, Australia; J. A. Gomes, Bombay; J. C. Rishworth, Kolar Gold Fields, India; R. B. McMillan, Melbourne, Australia; J. G. Guanaderai, Trichinopoly, S. India; C. J. McCain, Sydney, Australia; B. D. Joshi, Almora, India; R. D. Gomes, Bombay, India; J. Lyons, Penang, S.S.; J. W. Buckell, Montreal; J. Wilson, Wellington, N.Z.

An Interesting Layout Scheme

I have been very pleased to note that during the summer practically every Branch organised visits to railway works and depots. From them members cannot have failed to learn something of correct railway practice, in addition to gathering useful information of a general character; and the resumption of indoor track meetings will give them opportunities for putting this into practice.

A very interesting Branch scheme that has been reported shows how good use may be made of the knowledge gained in this manner. Members of this Branch have reproduced in miniature a section of actual railway in the neighbourhood. Repeated visits have been made to this section in order to make certain of all details, and as a result the model track corresponds with the original to the closest possible extent, including correct signalling.

I strongly recommend other Branches to try this idea. Interesting sections of real railways are within reach of all, and the reproduction of one of them is both interesting and instructive. The extent to which the reproduction can be carried out must, of course, depend upon the resources of the Branch. Generally speaking, however, if a fairly simple section of railway is chosen, there should be little difficulty in reproducing at least its main features. I shall be glad if any Branches that experiment on these lines will let me know the results, and send me a sketch of their layout with, if possible, a photograph.



More "prowling around"! Members of Farnham Grammar School Branch, No. 17, on "King Arthur" locomotive "*Sir Hector de Maris,*" No. 794, during a visit paid to the Eastleigh Railway Works of the Southern Railway

Train Controller of Model Railway

On the best of model railways, even with the most elaborate signalling arrangements, accidents are bound to happen occasionally. An absent-minded signalman may inadvertently cause two locomotives to crash head-on into one another, or some member may accidentally put something down on the track and forget to remove it until an express train crashes into it!

In order to prevent accidents of this kind, one Branch has adopted the excellent idea of appointing one member as Train Controller. The members take turns to act in this capacity, and the Controller appointed has complete charge of all track operations during his term of office, the remaining members working as railway officials under his orders. It is his task to ensure the prompt and efficient running of all trains in accordance with a prearranged timetable, and members of this particular Branch have found that loyal support of the Train Controller's orders enables them to spend a most instructive and interesting evening.

One great advantage of the scheme is that each member gains valuable experience when taking his turn as Train Controller. The more ambitious ones are not content with despatching trains in accordance with the prepared timetable, and when suitable opportunities occur introduce a few "Specials!" This provides very useful practice, for not only must a locomotive and coaches be supplied at short notice, but arrangements for the passage of the train with the least interference to ordinary traffic also must be made with signalmen and stationmasters along the line over which it is to be operated.

Locomotive Repair Fund

When an accident does occur it may be of such a serious nature that damage is done to rolling stock, and its repair necessarily involves expense. If the damaged locomotive, coach or wagon belongs to the Branch, clearly it is from the general funds that the cost of its repair should come. If on the other hand it is the property of a member, it is unfair that he should be called upon to sustain the loss.

Several Branches have provided for this by the issue of a special repair fund, to which members contribute small weekly sums. If each member contributes only 1d. per week, such a fund quickly reaches substantial proportions, and the knowledge of its existence encourages members to bring to the Branch meetings their railway material.

Branch Notes

ENGINEERING SOCIETY (ASHVILLE COLLEGE, HARROGATE).—Has made steady progress during the past month. A welcome donation of £1 has enabled the Branch to make further purchases of rolling stock, of which it now possesses a satisfactory quantity. On School Speech Day members gave a demonstration on the Branch layout, attracting the interested attention of visitors.

CHISWICK.—The first general meeting was held at Chiswick Park Station, but unfortunately further work cannot be done in a satisfactory manner until a permanent Branch meeting place has been secured. Any reader who can assist in finding one is asked to communicate with the Secretary, C. P. Griggs, 25, Elliott Road, Chiswick, W.4.

GLOUCESTER.—An outing to Sudley Halt in the Forest of Dean was interesting and enjoyable. While waiting at Newnham, members inspected the tank engine that hauls the auto train used on the branch line over which the journey was completed. A Roman road, and the third longest span of suspended overhead electric cable in the world, were other objects of interest seen during the outing.

BLACKPOOL (NORTHERN SECTION).—The Chairman has purchased three electric locomotives and a quantity of electric rails, and members are keenly interested in the prospect of establishing a complete model electric railway. Work on the Branch track is steadily proceeding, and a complete system of signalling has been installed. The signals are being specially made by members in order that trains may be controlled strictly in accordance with the correct railway practice.

WINDSOR COUNTY BOYS' SCHOOL.—Members have been divided into sections representing the four chief railway groups, the Branch's railway material having been distributed equally among them. Competitions between the sections are very keenly contested. The first of these was a Layout Contest, in which chief honours were won by the G.W.R. Section, the S.R. group being second.

FRIENDS' SCHOOL, WIGTOWN.—Has held very successful meetings, excellent timetable working being carried out. Attention has been paid to maintenance, the whole of one meeting being devoted to a thorough overhaul of rolling stock and locomotives.

NEW EARSWICK (YORK).—A cycle trip to a quarry enabled members to examine the locomotives and rolling stock of the Sand Hutton Light Railway. Another interesting visit was paid to the Cocoa Works of Rowntree Ltd.

LENTON SANDS.—The Branch layout is growing in a satisfactory manner. Double track has been introduced and found to be far superior to a double line made by using two single tracks. It is proposed to publish a Magazine, one purpose of which will be to keep a record of the Branch's activities.

SUTTON AND DISTRICT.—A visit to a signal cabin was very interesting and instructive, members considerably improving their knowledge of railway signalling. On the Branch track trains are always run to timetable, and now special attention is being given to correct signalling.

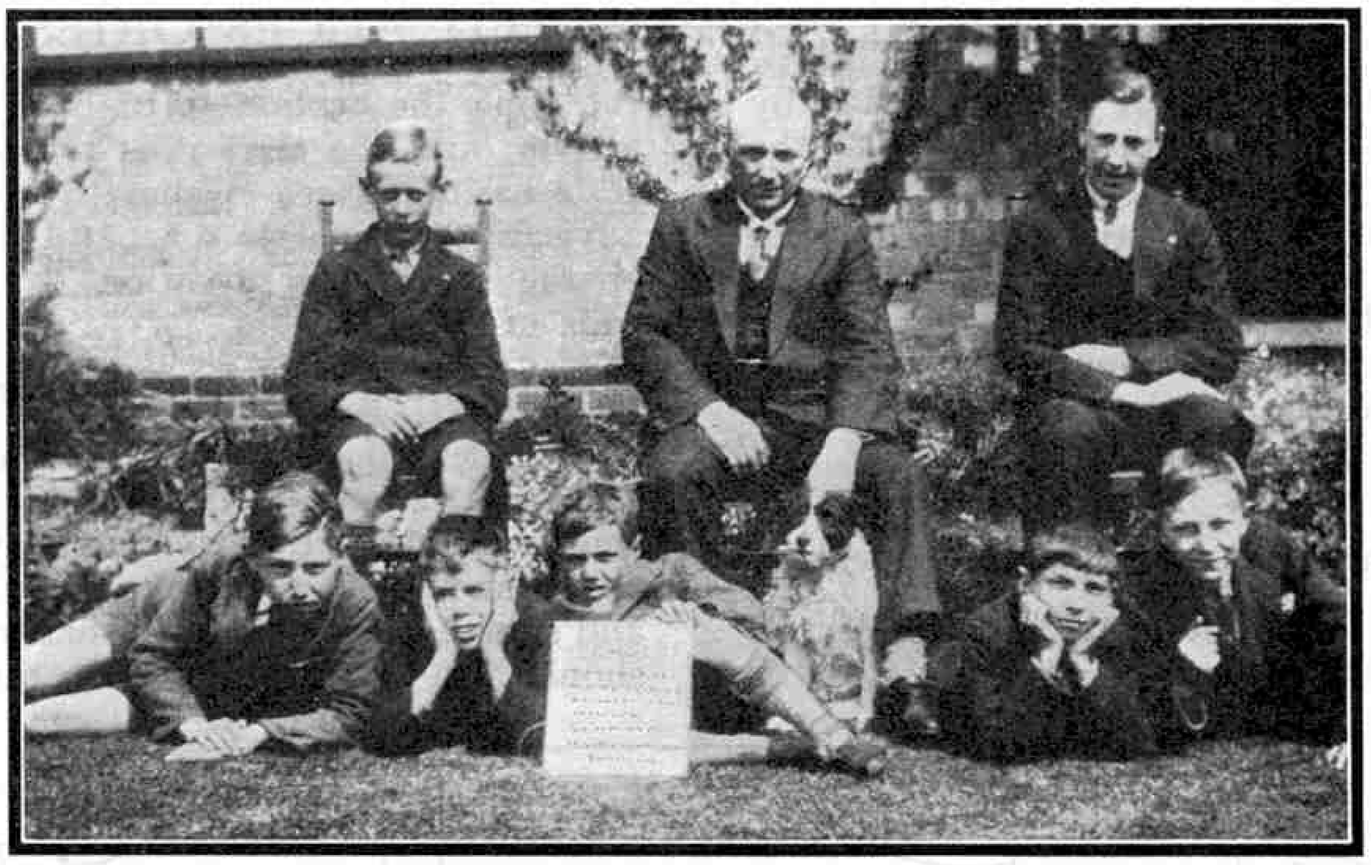
WHERWELL.—Special attention has been paid to layouts. Members have experimented with many of those shown in the booklet "*How to get more fun out of your Hornby Trains*," in order to enable them to design one to suit their resources.

BROOKFIELD (WIGTON).—The Library is a special feature of the club, the large selection of railway literature being very popular with members. An outdoor track has been laid down on long pieces of wood, very fine gravel acting as ballast, and tests of the pulling power of various engines have been made on this track. A joint Hornby Train Display was given by the two Brookfield Branches.

MONTPELIER (BRISTOL).—Work on the outdoor track is alternated with visits to interesting points on local railways and to the docks. Regular Saturday afternoon Rambles have been organised, mostly with a view to examining railway workings and layouts, and members have enjoyed several excellent games of cricket.

WOODFORD.—Has held a Garden Féte in order to increase funds available for purchase of railway material. One member has been nominated Buyer, his duty being to purchase any accessories or materials required. A small Cup has been bought to be awarded to winners of periodical competitions.

WEST HARTLEPOOL.—Interest of members is increasing, and they are now busy in the construction of a support for a large track passing round the club room. Wood for this purpose has been presented to the club.



Members of the Lenton Sands Branch, No. 2; General Manager, Mr. Hewson, Secretary, F. W. Byron. During the summer members of this Branch have paid many visits to places of railway interest, and in operations on their own layout have made excellent use of knowledge thus gained

Further Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promotors, whose names and addresses are given below. All owners of Hornby trains or accessories are eligible for membership and the various secretaries will be pleased to extend a warm welcome to all who send in their applications :—

BIRKENHEAD.—J. H. McGuinness, 63, Beresford Road, Oxton, Birkenhead, Cheshire.

CORK.—T. Barker, 13, Union Quay, Cork, Ireland.

HOUNSLOW.—R. Stevenson, 10, Bulstrode Parade, Lampton Road, Hounslow, Middlesex.

LEEDS.—K. R. Emmett, 7, Tower Grove, Upper Armley, Leeds.

LIVERPOOL—Wm. Tuer, 18, Montague Road, Old Swan, Liverpool.

LIVERPOOL—G. Kennedy, 111, Kenmare Road, Sefton Park, Liverpool.

LONDON, S.E.26—J. D. Davies, 28, Kingsthorpe Road, Sydenham, S.E. 26.

NORTHAMPTON—B. S. Godfrey, "Haverberg," Baring Road, Northampton.

OXFORD—S. Rhodes, 45, Canning Crescent, Abingdon Rd., Oxford.

OXFORD—D. J. Badham, 203, Woodstock Road, Oxford.

PENRITH—J. Horn, The Pelican, Greystoke, Penrith.

WORCESTER—R. C. Cole, 103, High Street, Worcester.

OVERSEAS

AUSTRALIA.—Colin Aldridge, 65, Kilgour St., Victoria, Australia.

JOHANNESBURG.—H. Jacobson, Box 1124, Johannesburg.

Further H.R.C. Incorporated Branches

53. HYNDLAND (GLASGOW).—M. C. S. Higgins, 6, Beaumont Gate, Glasgow, W.2.
54. WOODFORD—J. H. Skelt, "Walberswick," Woodside Road, Woodford Wells, Essex.
55. CHISWICK—Cyril P. Griggs, 25, Elliott Road, Chiswick, London, W.4.
56. ST. CHADS (WITHINGTON)—M. S. Macfarlane, 34, Clarence Road, Chorlton-cum-Hardy, Manchester.
57. WESTCOTT (DORKING)—J. O'Neill, Stanwick Mansions, West Kensington, London.
58. CHELTENHAM—D. W. Lloyd Davies, "Montgomery," Naunton Lane, Cheltenham.
59. WEST HARTLEPOOL PROGRESSIVE—Wm. H. Smith, 48, Hurworth Street, West Hartlepool.
60. NELSON (NEW ZEALAND)—Frank Curran, 9, Wainui Street, Nelson, New Zealand.
61. WALGROVE (CHESTERFIELD)—S. Wheatcroft, 50, Walton Road, Chesterfield.
62. THE PIRN HOUSE (INNERLEITHEN)—Mr. Jack L. Prior, The Pirn House, Innerleithen, Peeblesshire.

XI.—ELECTRICALLY-OPERATED ACCESSORIES

WE receive many enquiries from owners of Hornby clockwork railways for advice in regard to the installation of various electrically-operated accessories. There are many electrical devices that can be added to clockwork railways with very little trouble, and there is no doubt that these add very considerably to the interest of a layout. This month, therefore, we give a few hints that will be useful to H.R.C. members who are contemplating the development of their line in this direction.

Automatic Electric Lighting of Model Stations

First of all we will deal with the installation of electric light in a station in such a manner that the light is switched on as a train passes through, or while it is standing in the station. The first point to be considered is the position of the lamps, and this depends to a great extent upon the type of station to be used. In the case of the Hornby Station No. 2, the most convenient position for the lamps is in the chimney stacks under the roof of the station. In this case, however, it is necessary to have the doors of the waiting and refreshment rooms open in order that the light may stream out on to the platform. The alternative is to place a Hornby Single Lamp Standard in a suitable position at each end of the platform, and this is also the best method of dealing with the Hornby Station No. 1, and the Hornby Goods Platform.

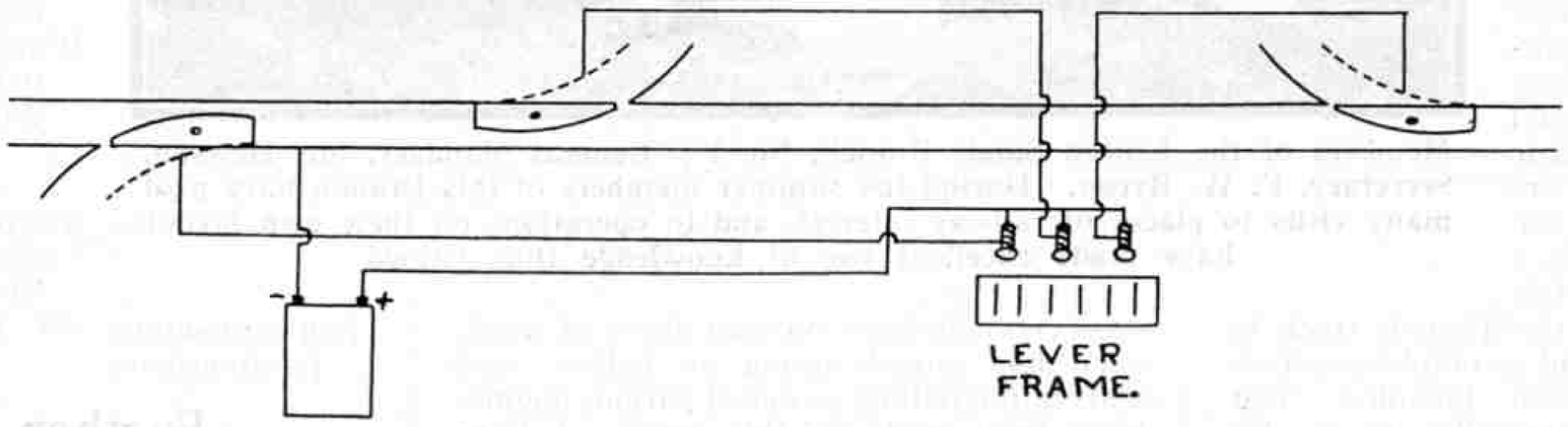


Diagram showing the method of wiring for three point indication lamps. It is advisable to take the wire from each insulated section to one of the lamps, while the three lamp socket terminals are connected together and taken to one terminal of the battery. The other battery terminal is connected to the uninsulated running rail

The lamps themselves may be ordinary flash-lamp bulbs used in connection with the Meccano Lamp Socket, which has a bolt and two nuts fitted to the fibre base to form a terminal. When two lamps are used it is advisable to connect them in parallel; that is the terminals on the base of the lamp sockets are both joined to one wire, and the outside connections of the sockets both joined to another wire. The two wires are then taken in the most convenient manner to the battery, which may be of the ordinary flash-lamp type or a 6-volt accumulator.

The next step is to insulate a section of the running rails, and the length of this section will be governed by the time the station is to be lighted before the train arrives, and the time it is to remain lighted after the train has departed. Generally speaking it will be found advisable to insulate a length of rail outside each end of the station, in addition to the rails between the ends of the platform.

Simple Method of Rail Insulation

In order to carry out the insulation, the clips on each side of one of the running rails should be lifted gently upward so that the rails may be lifted out. Brown paper should then be gummed to the bottom flanges and side of the rails, and insulating tape or brown paper should also be placed between the clips on the sleepers. When this is done the rails should be replaced in their original position and the clips pressed down. This should provide quite sufficient insulation for the purpose, but care should be taken that the paper or tape is not damaged in replacing the rails, otherwise there may be a short circuit and the system will not work.

The connecting pins joining the insulated rails together should be left in, but the pins at each end of the insulated section, connecting this with the non-insulated rails, should be removed in order to break the circuit. It is necessary for the rails to be kept in position, however, and for this purpose match sticks should be inserted to replace the metal pins.

To connect up the lighting system, a wire from one terminal of the battery is taken to the insulated running rail; a wire from the other running rail is taken to one of the lamp wires in the station; and finally a third wire goes from the other lamp wire back to the battery.

How to Trace Faulty Connections

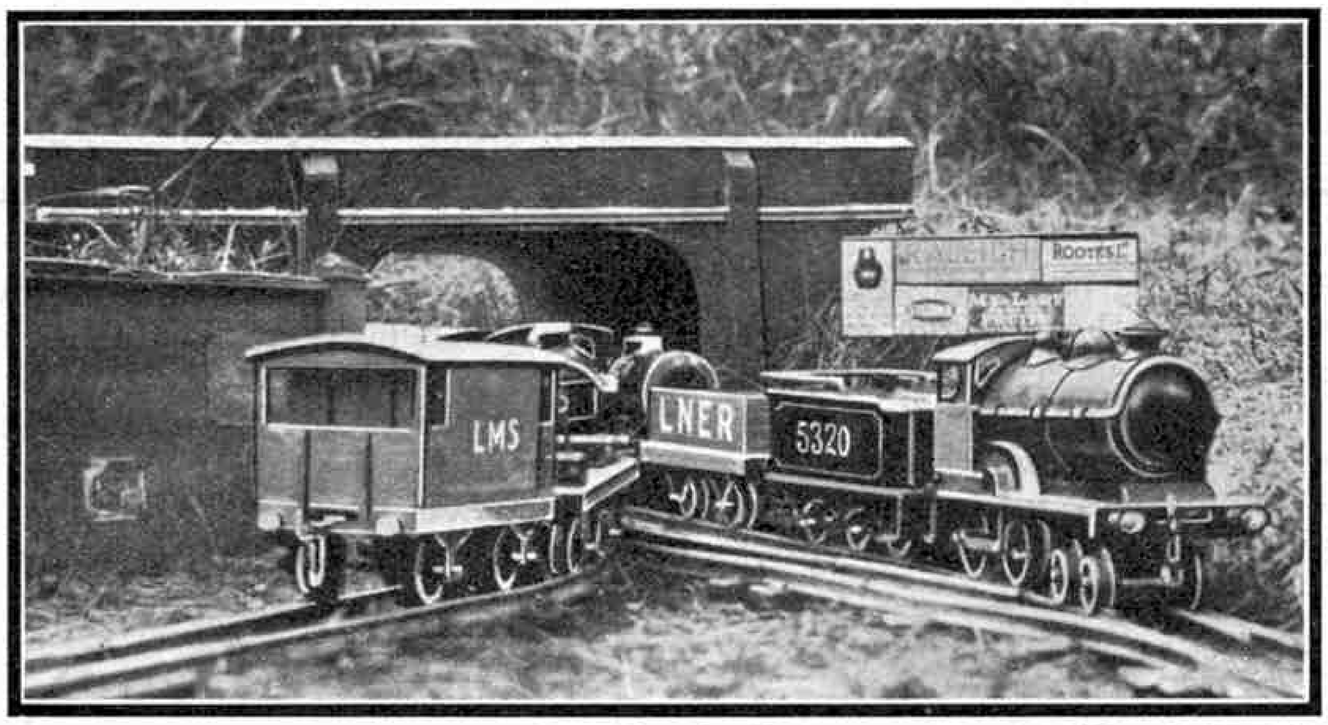
When the installation is connected up, the two rails should be bridged by placing a locomotive or wagon in the station, and the lamps should then light up. If the lamps do not light up the trouble may be due to a poor or loose connection from the rails, or to dirt on the running surface of the rails or on the wheels of the vehicle.

If a fault in the rails is suspected, the wire running

from the un-insulated rails should be taken to the battery, and if the lamps then light up it will prove that there is a poor connection to the rails from the battery. If there is still no result, however, the wiring of the lamps should be carefully examined to see that there are no short circuits or wrong connections. When the lights are in working order it will be found that as soon as the leading wheels of the locomotive approaching the station reach the insulated portion of the track—or, as it is called in actual railway practice, the track circuit—the lamps will light up and remain lighted until the last axle of the train has passed over the insulated section.

This method of lighting a station is well worth a trial. The installation is easy to fit up—easier than it may sound from this description—and it is most fascinating to watch the lights automatically switch on as the trains enter the station, and switch off again when the trains have passed through.

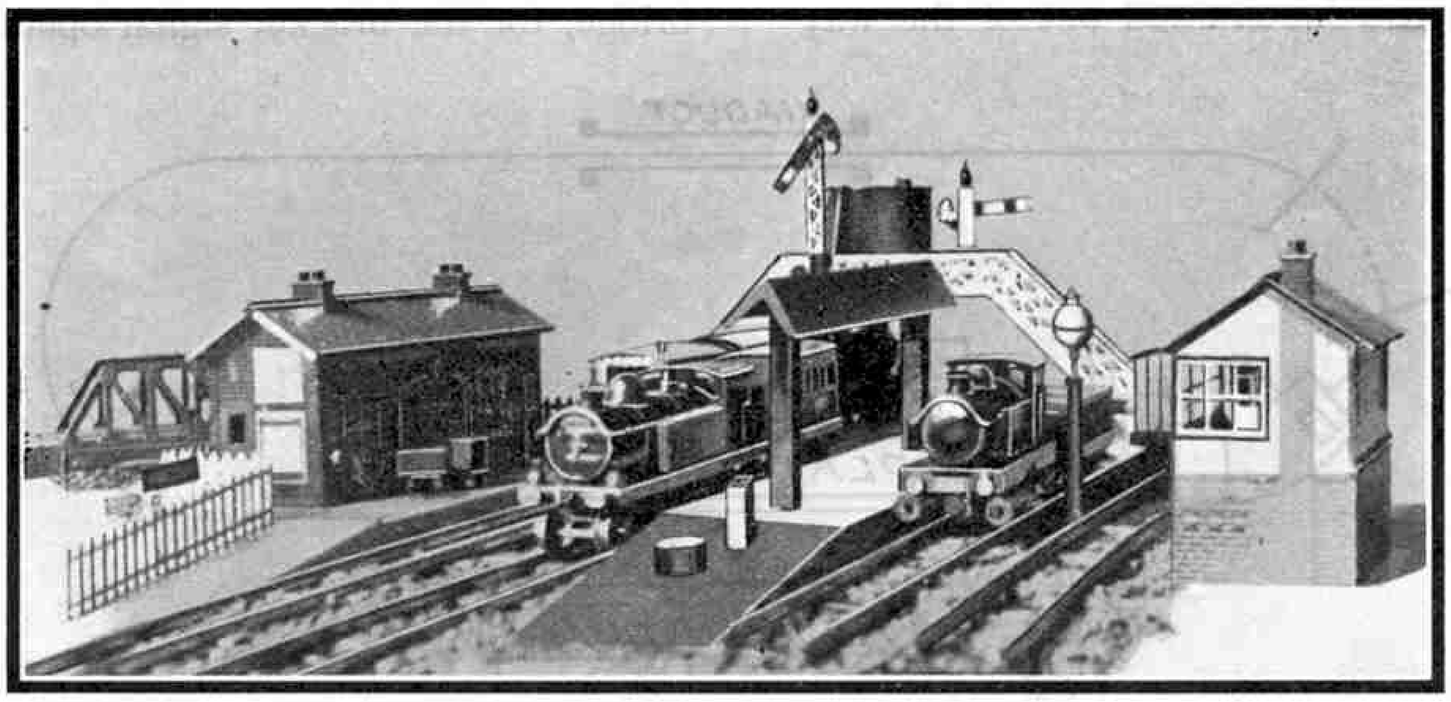
If it is not desired to alter the track in the manner just described, the lights may be controlled from one point by means of a switch. This method, however, has none of the fascination of the automatic operation by the trains themselves.



An interesting view on the outdoor Hornby Railway of Patrick Wyand (H.R.C. No. 3934). The bridge, which was made from an old tea chest, is very realistic, and its appearance is enhanced by the lineside advertisements

Fitting Lamps to Hornby Lamp Standards

We have already referred to the use of Hornby Single Lamp Standards in connection with station lighting. These standards, and also the Hornby Double Lamp Standards, are also extremely useful for lighting sidings and goods yards. A Meccano Lamp Socket and bulb can be fitted inside the globe, and the two wires led from the globe over the pole and down the centre of the post, finally being taken out at the foot of the post and led to the battery. These lamp standards add a splendid touch of realism to any layout and should certainly be installed.



A busy station on the Hornby Railway operated by James Denham (H.R.C. No. 6420). The ballasting of the line is very effective

Very many model railway enthusiasts make use of Hornby Telegraph Poles to add to the railway-like appearance of their layouts, but as a general rule the poles seem to be treated purely as ornaments. It is quite possible to make the poles serve a useful purpose by carrying wires that convey an electric current.

In order to employ telegraph poles in this manner a number of them should be spaced at equal intervals from one end of the system to the other. Two wires should then be carried from end to end by means of the insulators on each pole. A suitable size of wire for this purpose is from 26 to 30 S.W.G., double cotton covered. Each of the insulators on the telegraph poles has a small groove in it, and the wires should be given one turn round these grooves. Provided that the wire is kept reasonably tight, this method of fixing will be found quite adequate.

An electric circuit carried round a layout in this manner can be utilised for a great variety of purposes. The possibilities are, of course, still further increased if two or more separate circuits are provided, by making use of the remaining insulators on the poles.

Point Detection by means of Lamp Indications

In all the latest schemes of power signalling, electric point detection plays a most important part. Many readers will be aware that in the case of ordinary facing points a mechanical point detector is used. This consists essentially of a flat blade with a hole in it passing below a plunger that is pushed downward when the signalman pulls the lever that lowers the "home" signal. If the condition of the points is correct, the hole in the detector blade is in such a position that the plunger can pass through it, and in that case the signal can be pulled "off." If there is anything wrong with the setting of the points, however, the plunger is not in line with the hole and cannot pass through it; consequently the signal cannot be lowered.

Where electric point machines are used, these are fitted with a mechanical lock actuated by a motor, in addition to a number of contacts that are made or broken when the points are changed. These electrical contacts are used for the purpose of giving a visual indication in the signal cabin, showing the state of the points; and also for ensuring that no levers controlling the signals on that route can be moved unless an indication is shown. For example, let us suppose that the indication to a certain pair of points shows "N," or normal, and that it is desired to move these points to a reverse position. The lever is pulled over to the "mid" position, and the indication light

(Continued on page 684)

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

Hornby Railway Company

JUNIOR SECTION

IX.—The Development of a Small Layout

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

EVERY day my postbag contains numbers of letters from H.R.C. members and other model railway enthusiasts who are running successfully a small model railway, and who wish to develop it. As a general rule expense has to be considered carefully, and these queries resolve themselves into a question of how to increase the scope and interest of a small layout on real railway-like lines with the smallest possible expenditure.

To consider individually the small layouts that are described to me, day after day, would be utterly impossible, and therefore I propose to commence with the one shown in Fig. 1. A simple layout of this nature is in use by large numbers of enthusiasts, and as far as it goes it is quite a good one. It gives a good long continuous run—the length of this being limited only by the number of rails available—and at the same time it makes possible simple station operations for both passengers and goods. A goods train can be shunted out of the way to allow the express to pass through, which in itself is quite an interesting operation. It is also possible with this layout to work out and follow a time-table, although obviously this must be of the simplest possible nature.

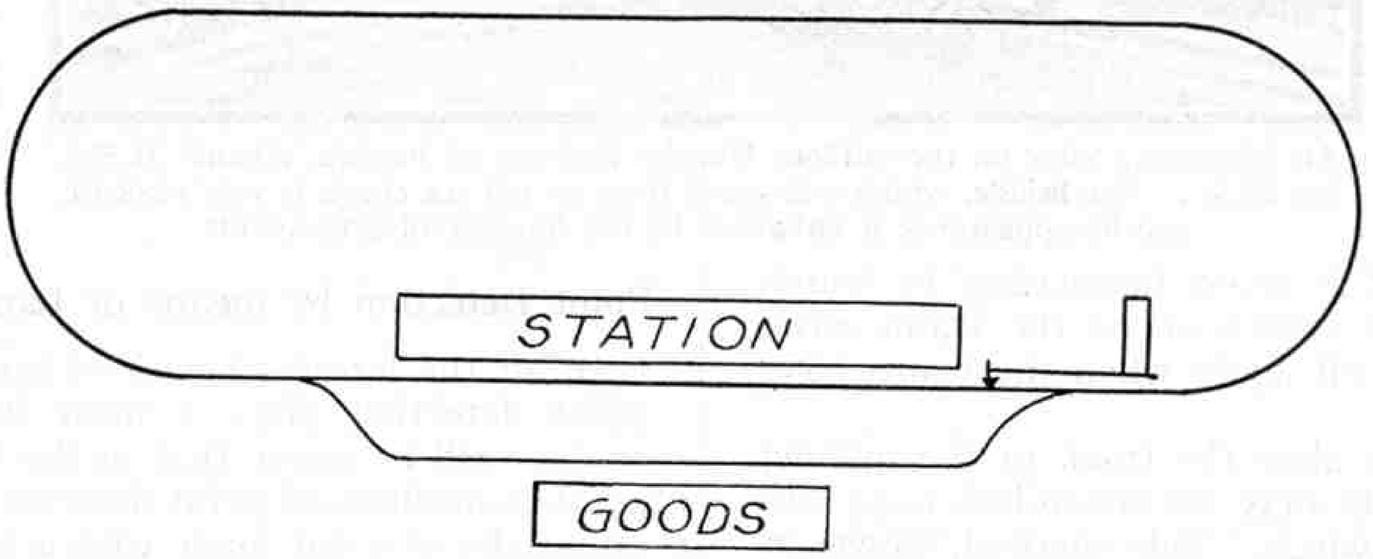


Fig. 1. A simple layout comprising an oval and a loop line allowing two trains to work at the same time

Now let us suppose that we have exhausted the possibilities of our layout and that we want to develop it in such a manner as to increase the scope of our operations. Fig. 2 shows one practical method of doing this. The oval formation is still retained, but it has been enormously improved by the addition of an extra passenger station, and the provision of a goods and carriage siding in addition to the loop line. No railway is perfectly flat, and therefore in order to add to the realism of the layout, a viaduct, a tunnel, and a level crossing have been installed suggesting that the line runs through undulating country. This effect could be greatly increased by the provision of a suitable scenic background such as has been described previously in these pages.

The level crossing is required to enable goods to be collected and delivered to the goods station, and in order to make matters complete there should also be a footbridge, by which passengers can gain access to each platform without crossing the line. If there were no footbridge passengers would be compelled to cross the line in defiance of the regulation that is so familiar a feature on station platforms—"Passengers must cross the line by the footbridge provided for their convenience"

It should be noted that the most suitable footbridge for a station of this description is the Hornby Footbridge No. 1, without signals. Signals are not required on this bridge, for the bracket signal operates as the "home" signal for the station.

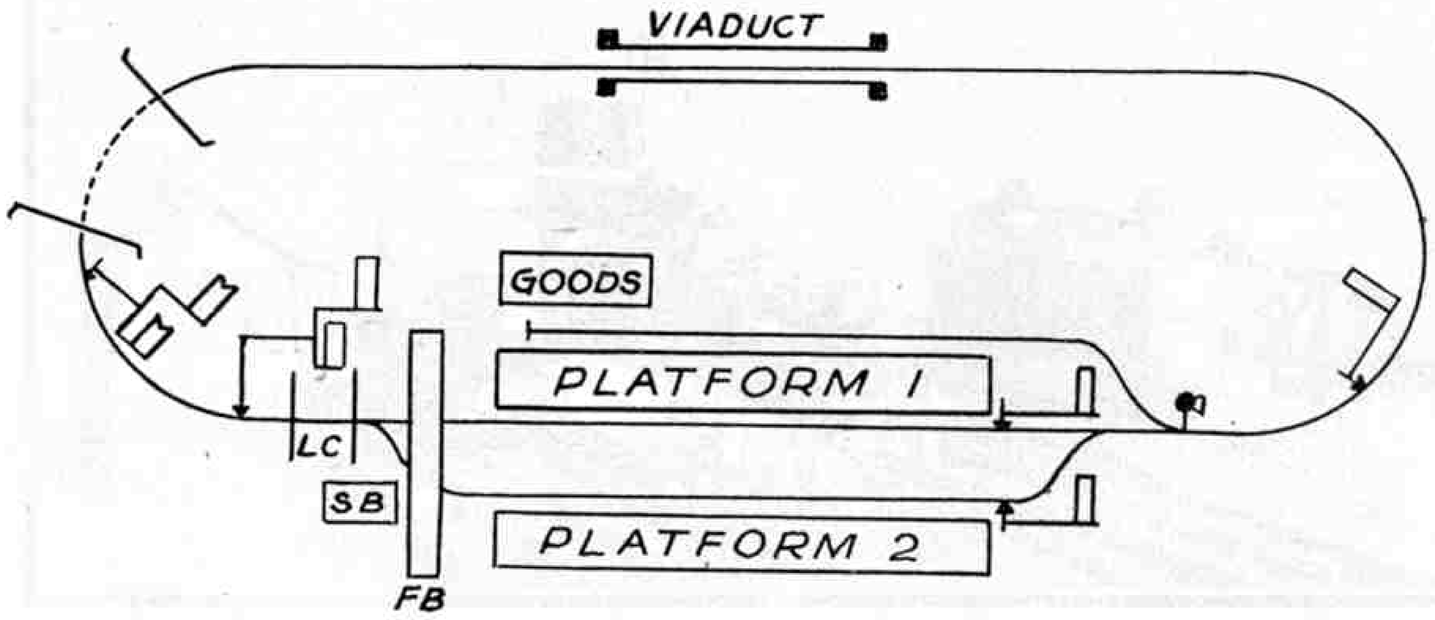


Fig. 2. An improvement on the preceding layout. The addition of a Footbridge (FB), Tunnel (shown by dotted line), Viaduct, Level Crossing (LC), Signal Box (SB) and other Train accessories considerably enhances the appearance of the model railway

This brings us to the question of signalling our layout. Although there has been recently a great increase in the number of H.R.C. members who give serious attention to signalling, there are still numbers who "cannot be bothered" to do this, and who regard their signals merely as ornaments to be placed in any position that seems convenient. I can assure all model railway enthusiasts that a definite system of signalling, operated in conjunction with the points, adds enormously to the interest of any layout, besides making it much more realistic. It is not necessary to have an elaborate or complicated system; it is only necessary to have a sufficient number of signals to protect the vital points

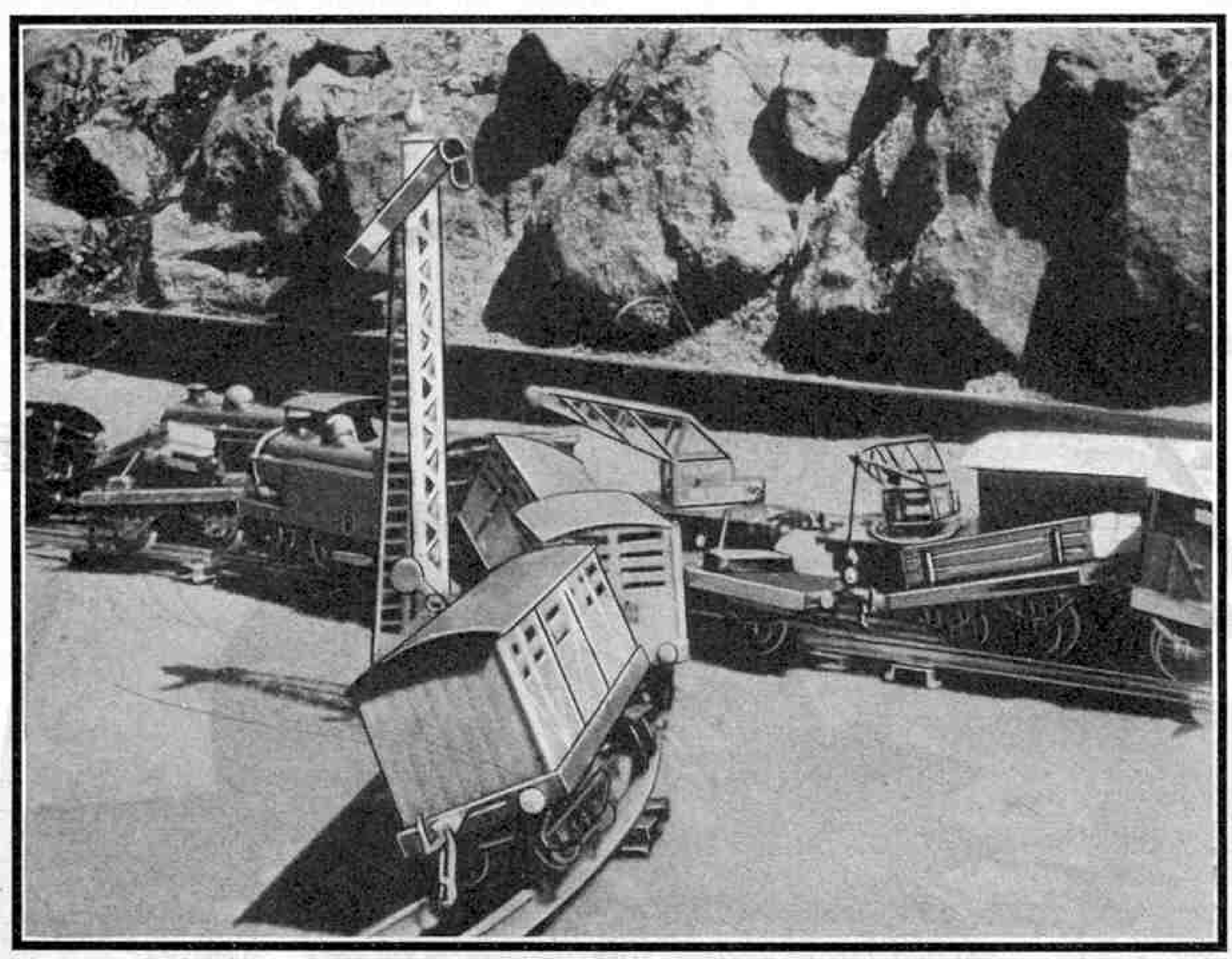
of the layout, such as crossovers and branch lines.

Fig. 1 is very simple to signal, and the arrangement shown in the diagram will be found sufficient for all ordinary purposes. Fig. 2 is a little more complicated, and it will be well to describe the functions of the various signals shown. For this purpose we shall imagine that we are on the footplate of a locomotive that is just emerging from the tunnel, and travelling towards the station.

The first signals we observe are the "distant" junction signals that repeat the "home" signals. These are situated just before the level crossing, and are controlled by the position of the gates, the signals always being "on" when the gates are open, and only pulled "off" when these are closed.

The higher arm refers to the main line, while the arm on the lower post indicates that there is a branch line to the right.

When the arm on the higher post is lowered we enter the station and come to a standstill opposite platform 1.



Our photograph demonstrates the disastrous results of an amateur signalman's inattention to duty! On real railways such mishaps as these are prevented by the use of interlocking between the levers

The signal at the end of the platform is known as the "starter," and our train cannot resume its journey until this signal has been lowered.

Now let us suppose that our train has to be put on the loop line so that when we emerge from the tunnel we find that the shorter arm of the "distant" signal is lowered, indicating that the corresponding arm on the "home" junction signal is in a similar position. After passing over the level crossing we find that our train is pulling up on the loop line against platform 2 used by the local trains.

Our engine has to work some trucks out of the goods siding, and so it is uncoupled from the coaches, the starting signal is lowered and we proceed along the main line until we are clear of the points leading to the goods siding. The ground disc on the goods siding will now be showing red, but as soon as we have passed the points these are changed over and the disc shows green, allowing us to proceed along the siding. It should be borne in mind that when the ground disc is giving the green indication it should be impossible to lower the "starting" signals at the end of either of the platforms. When the train is ready to leave the siding the "starting" signal at the end of the siding is lowered after the points have been pulled over, and the train once more proceeds along the main line clear of the points before backing into the station.

If for any reason it is not convenient to install at once a complete signalling system such as I have described, there is no reason why the installation should not be built up by degrees. The first signals to be installed should be the "home" junction signals, for these are to control the entry of the trains to the station. These signals might be followed later with a "starting" signal at the end of platform No. 2, and another at the end of the goods siding.

The whole fun in operating a signalling installation of this kind lies in the working of points and signals in conjunction. In the ordinary way this involves a number of hand operations, but by the introduction of the Hornby Control System both points and signals may be operated from a signal-box as in actual railway practice. This adds greatly to the railway-like appearance of the layout, and it also enables one or two operators to carry out schemes that otherwise would require a considerable "staff." The signal-box should be placed close to the level crossing as shown in the layout, Fig. 2.

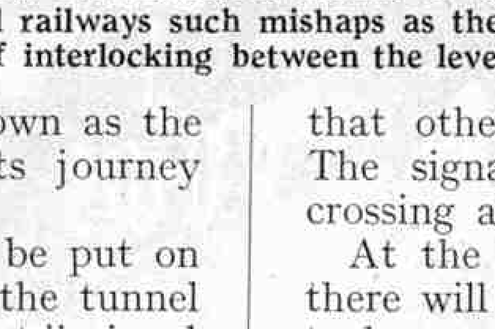
At the majority of stations where there are sidings there will be found a goods warehouse to enable goods to be conveniently stored when being transferred from the lorries to the railway trucks or vice versa. It may happen that a consignment of goods has been delivered at the station and it is necessary that the trucks should be released at once. In this case the trucks will be quickly unloaded and the consignment will be stored in the warehouse until it is called for.

The Hornby Goods Platform is an accurate representation of its prototype, being provided with a crane at the end of the platform to facilitate the transferring of heavy loads. In order to control the load the crane is fitted with a ratchet mechanism. The load is lifted out of the railway wagon and the crane is revolved until the load can be placed in position. It will be found that the addition of this accessory will add considerably to the interest of working the goods siding of a small station.

The crane supplied with the Hornby Goods Platform may be purchased separately and installed in a central position at the sidings to cope with heavy loads.

Suggested Layouts

No. 3



1′ **Radius** (as illustrated): 10 Curves, 7 Straights, R.H. Points, L.H. Points.

2′ **Radius**: 22 Curves, 16 Straights, R.H. Points, L.H. Points.

A Book for Every Railway Enthusiast

This fine book contains a feast of splendid reading for all who are interested in railways. The author, Mr. Cecil J. Allen, is easily the most popular writer on railway subjects and his lectures and B.B.C. talks are always looked forward to with keen interest by thousands of railway enthusiasts, both young and old.

The "Famous Trains" book tells the story of thirteen famous expresses of Great Britain. It describes the routes over which they run, the speeds attained, and the times of departure and arrival. In most cases an explanation is given of some special feature of the particular train dealt with. Thus, the "Flying Scotsman" article touches on articulated vehicles; the "Cornish Riviera" on slip coaches; the "Royal Scot" on steep gradient climbing; the "Atlantic Coast" on rolling-stock and train make-up; the "Hook of Holland" on Liverpool Street traffic, and the "Southern Belle" on Pullman Car development, while the "Postal Train" article describes in detail the work of a Travelling Post Office.

Every boy who is keen on railways should add this book to his library. It is a splendid production, beautifully printed and profusely illustrated throughout.

200 pages
58 illustrations

Price 2/6
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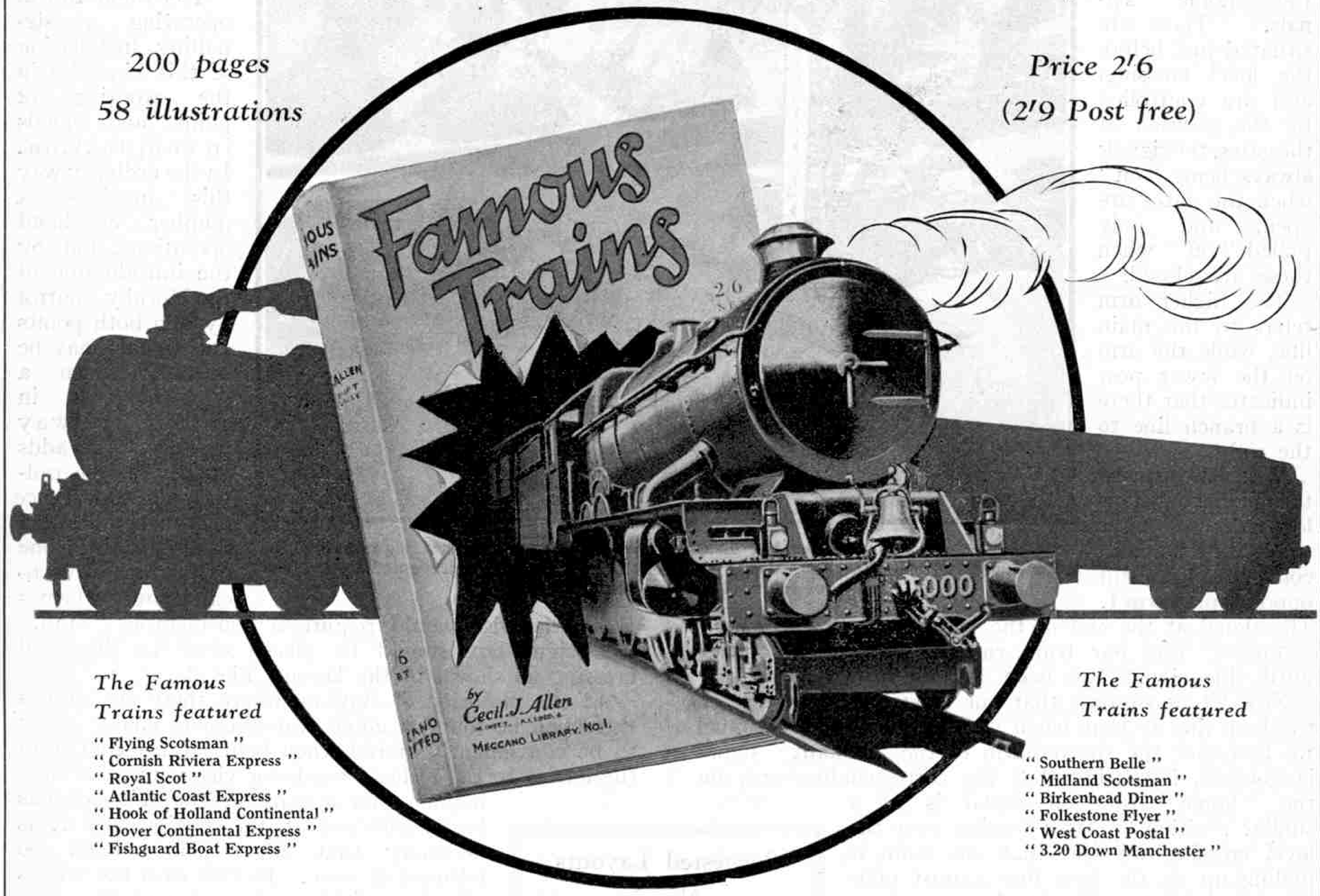


The Famous Trains featured

"Flying Scotsman"
"Cornish Riviera Express"
"Royal Scot"
"Atlantic Coast Express"
"Hook of Holland Continental"
"Dover Continental Express"
"Fishguard Boat Express"

The Famous Trains featured

"Southern Belle"
"Midland Scotsman"
"Birkenhead Diner"
"Folkestone Flyer"
"West Coast Postal"
"3.20 Down Manchester"

The "Famous Trains" book has been very favourably received by the Press. The following are a few extracts from reviews of the book:

"The author has described the journeys of thirteen famous trains and the routes over which they run with a wealth of detail, including time tables and engine dimensions, etc., to satisfy the most inquisitive The book is well printed and the illustrations are excellent"
"Mersey."

"The book is written in the popular manner that appeals to all boys. It is well produced, being bound in a stiff red linen cover and printed on art paper. It contains numerous illustrations from official and other sources."
"The Locomotive."

"For old and young boys and girls a fascinating book. The reader in imagination can take journeys in any of the famous trains in the four groups of railways, and possibly enjoy them to a greater degree than if the trips were actually taken. A copy of this excellent volume might well be the centre of attraction in every railway enthusiast's home."
"Railway Review."

"Mr. Allen's name is a sufficient guarantee of the quality and interest of the book, the value of which is much enhanced by a full and compact index."
"B.O.P."

"Few firms have done more to stimulate interest in railway affairs amongst boys than Meccano Ltd., and the Famous Trains Book is likely to stimulate still further that fascination that is every boy's birthright."
"Beardmore News."

"Mr. C. J. Allen's work is always popular with railway enthusiasts, and the easy style in which the thirteen chapters are written will make an irresistible appeal to boys.
"The publishers are to be congratulated on this first volume of the Meccano Library."
"L.M.S. Magazine."

The book may be obtained from any Meccano dealer or newsagent, price 2/6.
If preferred we can send it direct, price 2/9 post free.

MECCANO LIMITED Binns Road Old Swan LIVERPOOL

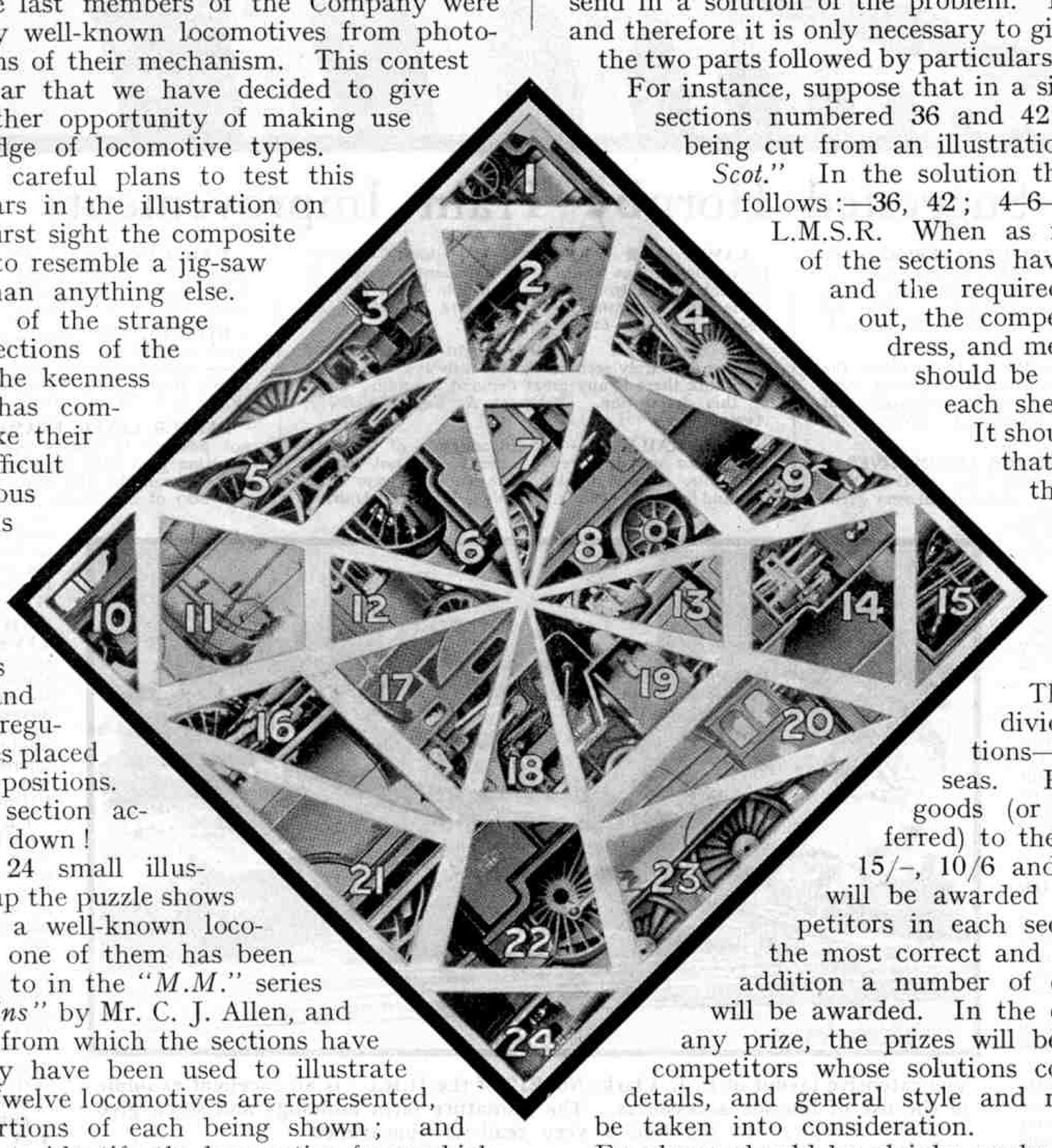
H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

Another Fascinating Locomotive Problem

In the H.R.C. Competition that appeared in the "*M.M.*" of June last members of the Company were asked to identify well-known locomotives from photographs of portions of their mechanism. This contest proved so popular that we have decided to give competitors another opportunity of making use of their knowledge of locomotive types.

The result of careful plans to test this knowledge appears in the illustration on this page. At first sight the composite picture appears to resemble a jig-saw puzzle rather than anything else. The explanation of the strange shapes of the sections of the picture is that the keenness of competitors has compelled us to make their task more difficult than in the previous competition. This has been done partly by using illustrations of smaller portions of mechanism, and partly by using irregularly shaped pieces placed in extraordinary positions. More than one section actually is upside down!



Each of the 24 small illustrations making up the puzzle shows some portion of a well-known locomotive. Every one of them has been specially referred to in the "*M.M.*" series on "*Famous Trains*" by Mr. C. J. Allen, and the photographs from which the sections have been cut actually have been used to illustrate these articles. Twelve locomotives are represented, two separate portions of each being shown; and readers are asked to identify the locomotive from which each part has been taken, giving its wheel arrangement, class, name of the railway company owning it, and so on. As many details as possible should be given, and special care should be taken to identify both sections of each locomotive shown in the illustration.

It is not necessary to cut out the sections in order to send in a solution of the problem. Each is numbered and therefore it is only necessary to give the numbers of the two parts followed by particulars of the locomotive. For instance, suppose that in a similar competition sections numbered 36 and 42 are identified as being cut from an illustration of the "*Royal Scot.*" In the solution this would read as follows:—36, 42; 4–6–0 "*Royal Scot*" L.M.S.R. When as many as possible of the sections have been identified and the required details written out, the competitor's name, address, and membership number should be written clearly on each sheet of paper used. It should be remembered that the omission of the H.R.C. membership number from any entry will cause it to be disqualified immediately.

The contest will be divided into two sections—Home and Overseas. Prizes of Hornby goods (or Meccano if preferred) to the value of £1/1/–, 15/–, 10/6 and 5/– respectively will be awarded to the four competitors in each section who submit the most correct and detailed lists. In addition a number of consolation prizes will be awarded. In the event of a tie for any prize, the prizes will be awarded to the competitors whose solutions contain the fullest details, and general style and neatness also will be taken into consideration.

Envelopes should be plainly marked "Loco Problem No. 2" in the top left-hand corner, and should be posted to reach Headquarters at Binns Road, Old Swan, Liverpool, on or before 30th September. Overseas, 31st December. Read over these instructions again before posting your entry.

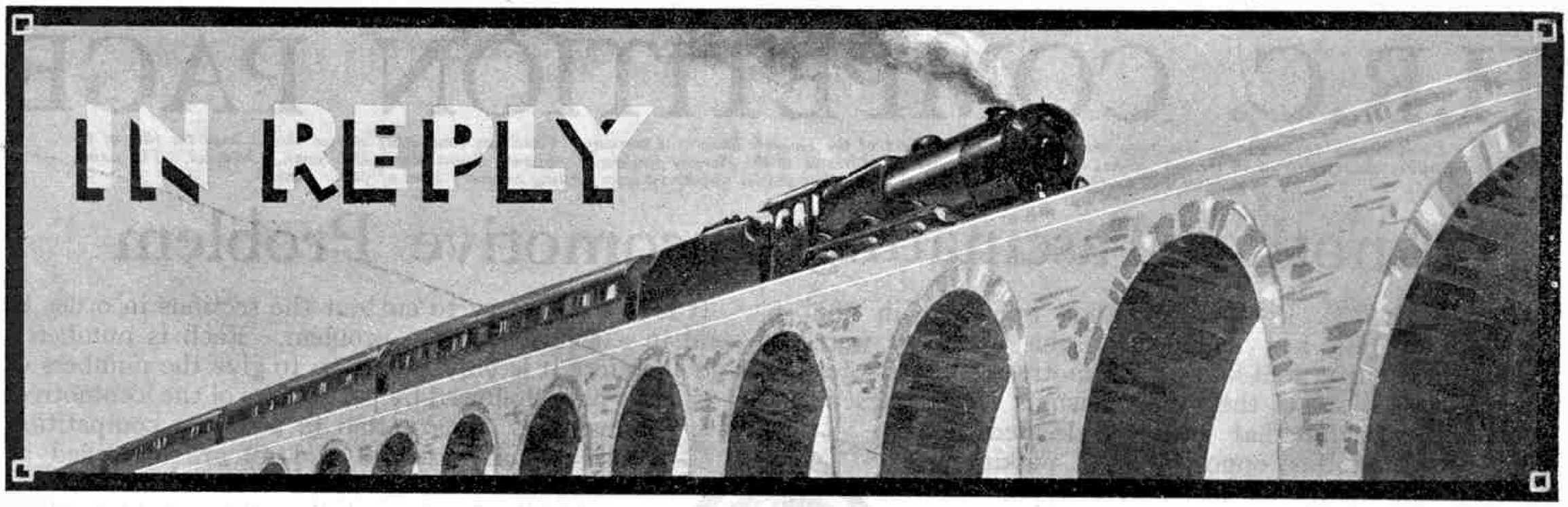
Second H.R.C. Essay Contest

We have received many letters expressing appreciation of the H.R.C. pages of the "*M.M.*", and some of the most complimentary remarks on this matter have been addressed to us from readers who are not members of the Hornby Railway Company. There has also been a sprinkling of criticisms and coupled with these have been some very helpful suggestions; these we have welcomed, for generally they have enabled us to effect some improvement in the H.R.C. pages.

We feel that there are many other helpful suggestions, however, that require only a little encouragement to be given expression, and with a view to achieving this we have chosen for the second H.R.C. Essay Contest the subject "How I think the H.R.C. pages of the "*M.M.*" could be improved." Essays should not exceed 500 words in length.

The contest will be divided into two sections, A for those of 16 and over, and B for those under 16. Prizes of Hornby Railway material (or Meccano if preferred) to the value of 15/–, 10/6, 5/– and 2/6 respectively will be awarded for the four most helpful essays in order of merit in each of the two sections. It should be noted that there is no Overseas Section for this competition.

The competitor's name, address, age and H.R.C. number must be clearly written on the back of every sheet submitted, and envelopes should be marked "Second Railway Essay" in the top left-hand corner. Closing date, 30th September.



Suggested Hornby Train Improvements

STEEL RAILS AND WOODEN SLEEPERS.—The cost of producing permanent way with steel rails and wooden sleepers would be too high in comparison with that of the present Hornby track, and we regret that we are unable to adopt your suggestion. (*Reply to J. Murgatroyd, Ferriby, Yorks.*).

THREE WAY POINTS.—We do not think the introduction of a three way point would prove very popular with the majority of Hornby enthusiasts and for the present we cannot consider it. (*Reply to P. Conway, Liverpool*).

EXTENDED KEY SHAFT FOR LOCOMOTIVES.—Your suggestion for an extended key shaft is very interesting, but the alteration would entail very great expense, and we doubt whether the gain would be sufficient to warrant the outlay. (*Reply to W. Davis, Lincoln*).

SIGNAL ARMS.—Hornby signal arms may be purchased separately in either "Home" or "Distant" patterns. They cost 3d. each. (*Reply to E. Shawl, Morecambe*).

RUSTLESS RAILS.—As previously stated Hornby track is not designed for permanent out-door working and the introduction of rustless rails would be far too expensive to prove popular with the majority of Hornby enthusiasts. (*Reply to R. Bibby, Westhoughton, Lancs.*).

BOGIE TRUCK FOR GRAIN TRANSPORT.—We are interested in your suggestion that a grain transport truck should be added to the Hornby System. Such a truck is of a very special character, and we do not think it would prove as popular as one which is of more universal use. (*Reply to J. Maxton, Southampton*).

SLIP COACHES.—The question of introducing slip coach working in the Hornby System has been under consideration for some time past. Experiments are now in progress, and we hope to be able to make an announcement on the subject in the near future. (*Reply to S. Frost, West Ham, London*).

WIDER TUNNELS.—Your suggestion that a wider tunnel suitable for double track should be introduced is interesting. Several ideas regarding improvements to the present Hornby tunnel have been received, and all are receiving careful consideration. (*Reply to H. Hickling, Loughborough*).

DETACHABLE BODY FOR VAN.—We are interested in your proposal for the introduction of a luggage van body to represent a furniture removal van, which could be lifted on and off a flat truck by means of a crane. Your idea will receive further consideration. (*Reply to J. Sexton, Stockton-on-Tees*).

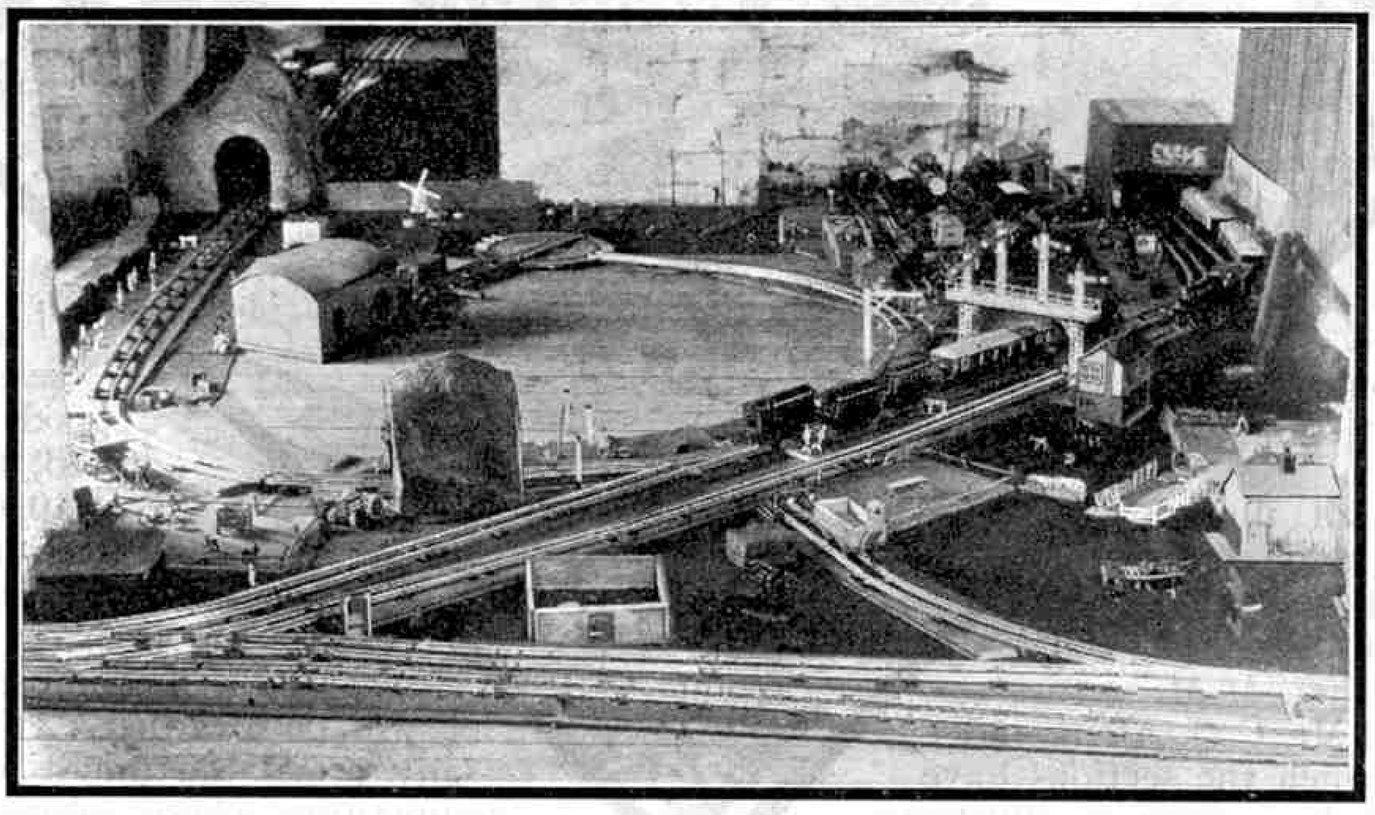
AUTOMATIC COUPLING FOR ROLLING STOCK.—The introduction of a system of coupling and uncoupling wagons automatically would certainly add to the interest of the Hornby System, but we fear that it would be complicated and expensive. We shall bear the idea in mind, however. (*Reply to D. Simpson, Gloucester*).

HORNBY GARRATT LOCOMOTIVE.—We agree that a miniature "Garratt" type locomotive would make an interesting addition to the Hornby System but as previously stated, the wheel base would be too long to enable the locomotive to negotiate the curves successfully. (*Reply to K. McKenna, Edinburgh*).

LAMPS FOR STATIONS.—We doubt whether lamps for stations would prove sufficiently popular to warrant their introduction. Suitable lamps may be made with Meccano electrical parts. (*Reply to B. Johnson, Anfield, Liverpool*).

No. 2 SHELL WAGON.—Eight-wheeled petrol wagons are rarely seen on British railways, and we do not think there is any great demand for rolling stock of this description. (*Reply to R. Caffin, Victoria, Australia*).

RACK RAILWAY.—The introduction of the rack system for use on steep gradients does not appear advisable. In our opinion there would be very little demand for such a system. (*Reply to W. Hirst, Aintree*).



The extensive layout of P. E. Clark (No. 212 of the H.R.C.) is an excellent example of the use of lineside accessories. The miniature farm buildings and stock give to the line a very realistic appearance

IMITATION COAL.—Your suggestion regarding the addition of imitation coal for the Hornby tenders is very interesting, but so far the demand has not been sufficient to warrant its adoption. We shall, however, keep the idea in mind. Those who wish may easily obtain a realistic effect by sprinkling coarse coal dust over cardboard that has been coated with gum and fixing this in the tender. (*Reply to T. Bedford, Chester*).

SINGLE BOLSTER LUMBER WAGONS.—Your suggestion that No. 1 lumber wagons should be fitted with single bolsters is quite interesting, and is being filed for future consideration. (*Reply to G. Jarrett, Clevedon*).

MIXED TRAIN SET.—A train composed of one Pullman Coach and several goods trucks would look very queer on a Hornby layout, and is certainly unusual in railway practice. We do not believe there would be a great demand for the introduction of a train set comprising this combination of rolling stock. (*Reply to E. C. Williams, Canada*).

HORNBY TRAMCAR.—We are not in favour of the introduction of a model tramcar to run on the Hornby electric rails, as such a vehicle could form no part of the Hornby Railway System. If required, a model of this type may easily be constructed from standard Meccano parts. (*Reply to C. Benson, Waterford and J. Watkinson, Birmingham*).

MAIL VANS.—We are now carrying out experiments with Mail Vans with a view to introducing them into the System. Further developments will be announced later. (*Reply to S. Ames, Guildford, Surrey*).

KITCHEN CAR.—We do not think there would be much demand for a Hornby model of a kitchen car. There are several more popular additions to be made to the Hornby System before we consider this idea. (*Reply to T. Martin, Derby*).

LARGER LEVER FRAME.—We realise that it is not possible to control operations in a very large shunting yard with our standard control lever frame. We will consider the introduction of a larger frame and also of detachable bell cranks, similar to those you suggest, to enable the rodding of the Control System to be taken from one side of the track to the other. (*Reply to W. Saxby, Chippenham, Wilts.*).

SHUNTING LOCOMOTIVE.—With regard to your suggestion concerning a small shunting locomotive, would not the existing No. 1 Tank engine answer your purpose? We fail to see that a special shunter would be of sufficient general interest to warrant its manufacture. (*Reply to S. Dowsett, Oxford*).

ELECTRIC COLLECTING SHOE DEVICE.—We note your suggestion that Hornby electric locomotives should be fitted with a device by means of which the collecting shoe may be raised clear of the live rail. We agree that this would be of value when it is desired to run two engines from the same circuit, for it would allow one to remain stationary whilst the other is in motion. Further experiments will be made in connection with your idea. (*Reply to J. Abernethy, Brisbane, Australia*).

IMPROVED METROPOLITAN LOCOMOTIVES.—Although your suggestion would greatly improve the Metropolitan Locomotives, we fear that the addition of two four-wheeled bogies and the provision of a flexible drive to one axle would increase its cost without materially improving its efficiency. (*Reply to A. Mattison, Hornsea, Yorks.*).

SIGNALS FOR POINTS.—We note your suggestion regarding the provision of coloured electric lamps at points and crossings. Although this idea is very interesting, we fear that such an article would show to advantage only in a darkened room, and we feel sure that Hornby enthusiasts would not prefer to operate their trains in the dark. (*Reply to I. J. Johnson, Wigan*).

PLATELAYER'S TROLLEY.—We note your suggestion for the introduction of a platelayer's trolley, but do not think that it would be a popular addition to the Hornby System. (*Reply to L. Kemp, Douglas, I.O.M.*).

EXTENSION OF WINDING SPINDLE.—We do not consider the advantages to be gained by extending the winding spindle to both sides of a locomotive would be sufficient to warrant the necessary alterations. (*Reply to R. Scott, Bootle*).

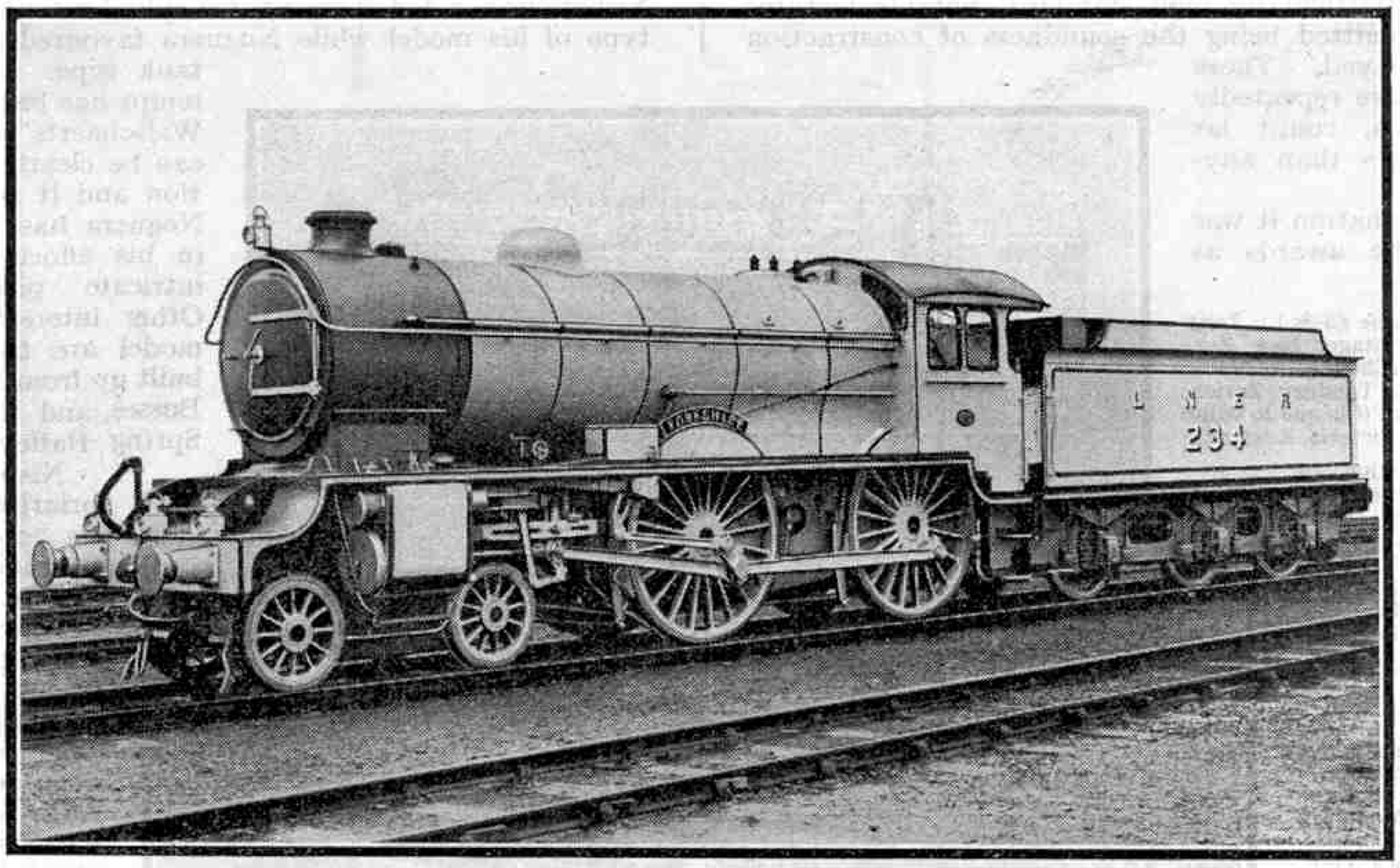
CHECK RAILS.—The addition of check rails to Hornby curves to guard against derailments is not necessary. Providing that the track is carefully and securely laid, such accidents should be very rare. (*Reply to W. Peters, Cadishead*).

New Locomotives of the Hornby Series

By 'Tommy Dodd'

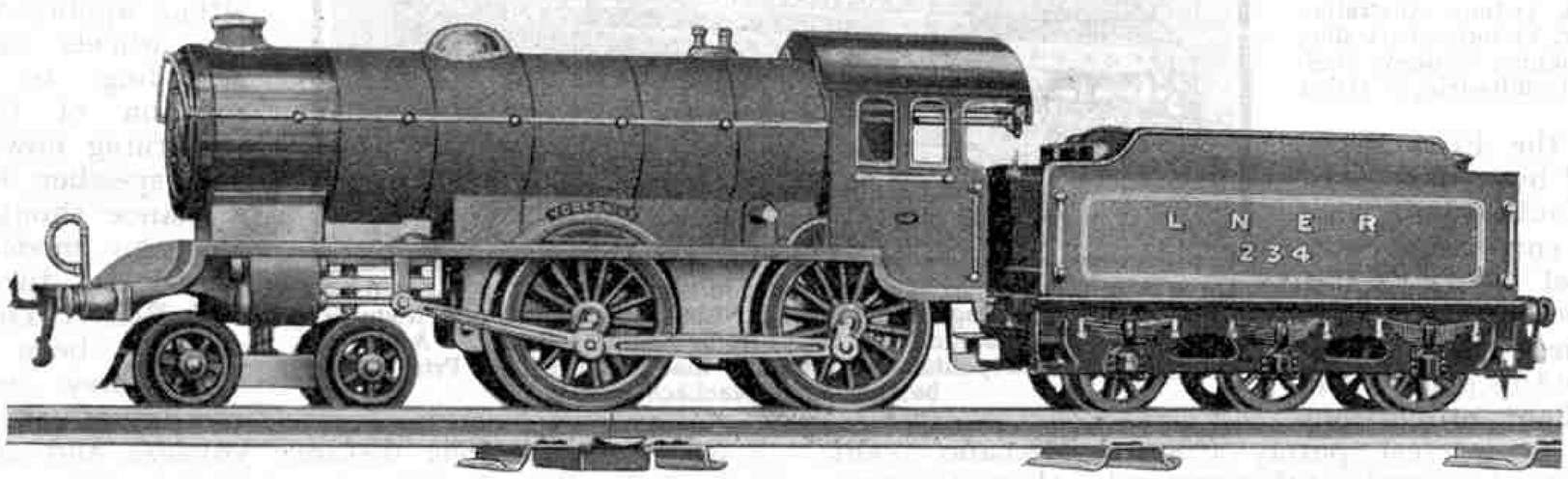
AN entirely new range of Hornby locomotives that is being introduced this year will, I believe, prove one of the most popular features of the whole Hornby System. These locomotives are known as the Hornby No. 2 Special Passenger Locomotives.

They have been specially designed to represent famous 4–4–0 types that are now in the service of the four big railway groups, and in almost every detail they are accurate models of their prototypes. The clockwork mechanism with which they are fitted is of exceptional strength, giving a great length of run and at the same time enabling big loads to be hauled with ease. The running of these locomotives affords a splendid example of what can be accomplished by a good design carried out in the best quality of materials by perfect workmanship.



No. 234, "*Yorkshire*," of the L.N.E.R. 4-4-0 "Shire" class

A feature to which I wish to call special attention is that each of these locomotives is fitted with four brackets on which detachable headlamps may be placed. It is therefore possible to arrange the lamps in accordance with the code used on real railways, thus indicating accurately the type of train. Large numbers of Hornby Railway enthusiasts have expressed a desire for detachable headlamps, and therefore I know that the introduction of this feature will prove exceedingly popular with all H.R.C. members.



The realistic "true-to-type" Hornby model of the L.N.E.R. "Shire" locomotive shown in the upper illustration

Each locomotive is enamelled in the correct colours of its original, and the general finish is probably the most perfect that has yet been attained in locomotives of the Hornby series.

For the L.N.E.R. representative we have selected a model of the famous "Shire" class locomotives. These three-cylinder engines were introduced in 1927 for the purpose of working the lighter express services in the north-east of England and in Scotland. They are the heaviest and most powerful examples of this type that have been produced so far, for they possess a tractive effort of 21,550 lb. at 85 per cent. of the boiler pressure. Twenty-eight of these engines have been built, and they are all named after English or Scottish shires. Our model is based upon the first of this type that was turned out from the Darlington Works and bears the name "*Yorkshire*," No. 234. The accompanying illustration will give some idea of the handsome appearance of this locomotive.

One of these L.N.E.R. models was running regularly on the Meccano Stand at the recent Jamboree at Arrowe Park, Birkenhead, and it aroused widespread admiration, both for its appearance and for its performance.

The L.M.S. model is a representation of one of the Midland Standard Compounds. The efficiency of these engines is abundantly proved by the fact that since the grouping, their numbers have been increased from 45 to 200, and they now work the majority of the short distance express services. These locomotives are unnamed and No. 1185 has been selected for our model.

The G.W.R. is represented by the "*County of Bedford*," No. 3821. These "County" class locomotives made their appearance in 1904, and for some time were used for express passenger traffic. There are at present 40 of these engines on the road. This is a very handsome model in every respect.

(*Continued on page 684*)

Results of Meccano Model-Building Contests

By Frank Hornby

"October" Competition, Overseas Section

IT is always interesting to examine the results in the "Overseas" Sections of the Meccano Model-building Contests, for models are sent in from all parts of the world and many wonderful and ingenious subjects are chosen for entry. The "October" Contest resulted in almost a record number of entries, the majority of which were of a particularly high standard, notable features of many models submitted being the soundness of construction and originality displayed. These two points, as we have repeatedly reminded competitors, count far more with the judges than anything else.

After careful examination it was decided to make the awards as follows:—

FIRST PRIZE (Cheque to value £3-3s.): Tony MacLachlan, Dunedin, Otago, New Zealand. SECOND PRIZE (Cheque to value £2-2s.): Robert and Otto Tondury, Zurich, Switzerland. THIRD PRIZE (Cheque to value £1-1s.): Jack Southern, Victoria, Australia.

SIX PRIZES, each consisting of Meccano products to value 10/6: P. L. Bargellini, Florence, Italy; Graham R. Nisbet, Mont Albert, Melbourne, Australia; F. W. J. Marshall, Peterborough, Australia; R. Brenni, Mendrisio, Switzerland; E. D. Pengelly, Jamaica, B.W.I.; D. Alfonso Espolet, Calle Finlandia No. 9-2, Barcelona, Spain.

TWELVE PRIZES, each consisting of Meccano products to value 5/–: W. Scott, Malvern, Victoria, Australia; E. Smith, Montreal, Canada; J. Hazard, Florence, Italy; W. Welsh, Ottawa, Ont., Canada; D. T. Wilson, Fredericton, New Brunswick, Canada; P. Anagnostopoulos, Athens, Greece; G. E. Schubz, Coromby, Victoria, Australia; N. Staie, Hamilton, New Zealand; S. Cooke, Ryde, Sydney, Australia; Roy Johnson, Katoomba, N.S.W., Australia; Luis M. Noguera, Buenos Aires, Argentine; Alan Jacka, Camberwell, Melbourne, Australia.

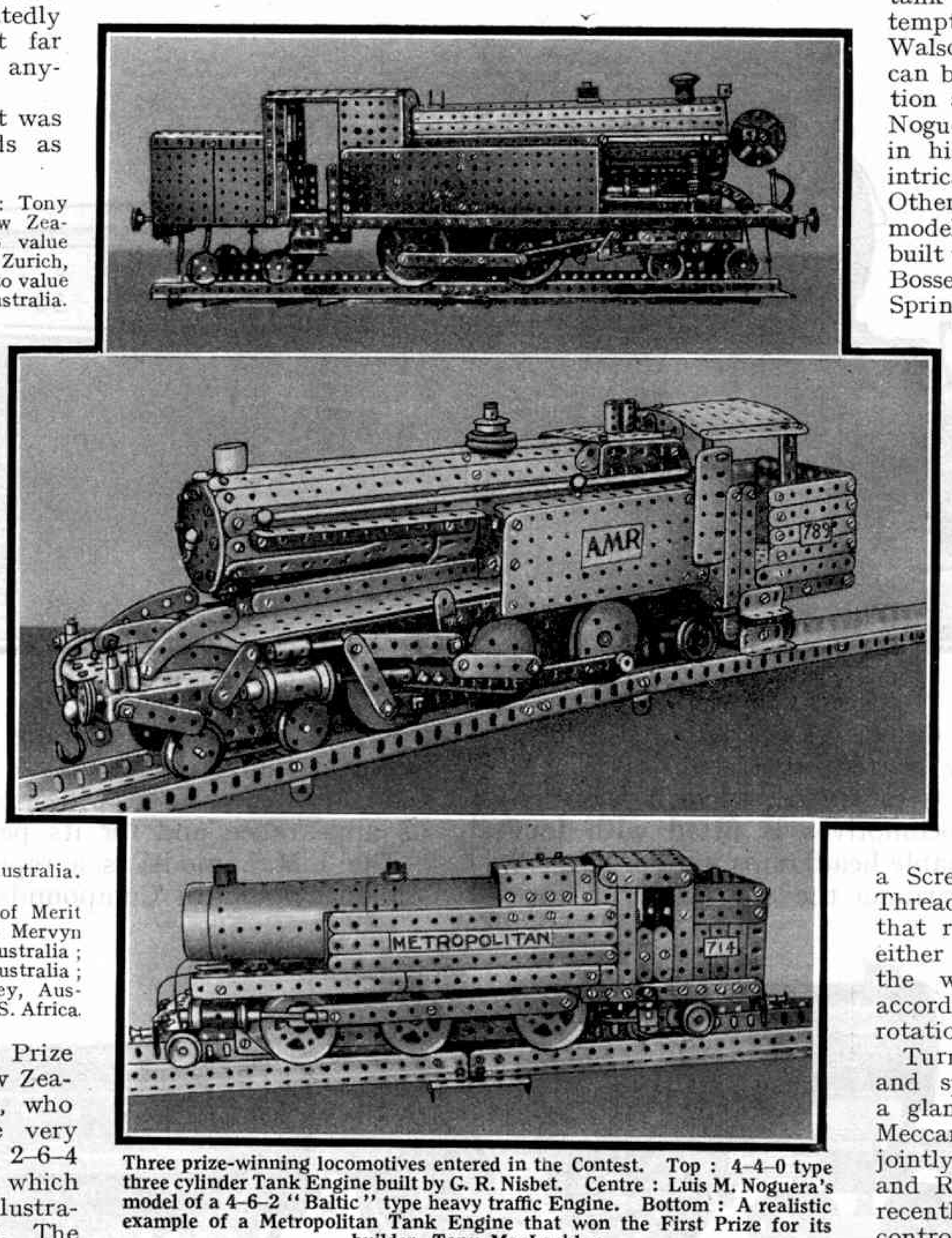
SPECIALLY COMMENDED (Certificate of Merit and Standard Mechanisms Manual): Mervyn A. Morgan, Homebush, Sydney, Australia; K. R. Downie, Carnegie, Victoria, Australia; Norman King, Willoughby, Sydney, Australia; A. Shepherd, Bloemfontein, S. Africa.

As will be seen the First Prize has been carried off by a New Zealand boy, Tony MacLachlan, who submitted as his entry the very fine working model of a 2–6–4 type tank locomotive, which is reproduced in the lowest illustration of the group on this page. The model is of excellent proportions and besides being of interest purely from a Meccano point of view it is a really good example of this particular class of engine, combining as it does all the principal structural features of the prototype. A further point of interest attaches to the model in that it is designed on an illustration that appeared some time ago in the *"M.M."*

The motive power is supplied by a Meccano Electric Motor placed in the firebox and current is taken from the rails by means of the third rail system. Sand pipes are fitted and the cab doors are hinged so that they may be opened or closed at will, while by judicious use of Chimney Pieces and Pulleys, MacLachlan has managed to produce very realistic cylinders.

In every Meccano model-building contest numerous competitors choose locomotives as the subject for their entry and it was therefore not surprising to find several really well built models of this type entered for the "October" Competition.

G. R. Nisbet and Luis M. Noguera are two further competitors who were successful in obtaining prizes for their model locomotives. Nisbet chose a 4–4–0 type three-cylinder tank engine as the prototype of his model while Noguera favoured the 4–6–2 "Baltic" tank type. In this latter an attempt has been made to reproduce Walschaerts' valve gear. This can be clearly seen in the illustration and it will be apparent that Noguera has been very successful in his effort to imitate such an intricate piece of mechanism. Other interesting features of the model are the lamps, which are built up from Eye Pieces, Threaded Bosses, and the bosses of Meccano Spring Buffers.



Three prize-winning locomotives entered in the Contest. Top: 4–4–0 type three cylinder Tank Engine built by G. R. Nisbet. Centre: Luis M. Noguera's model of a 4–6–2 "Baltic" type heavy traffic Engine. Bottom: A realistic example of a Metropolitan Tank Engine that won the First Prize for its builder, Tony MacLachlan

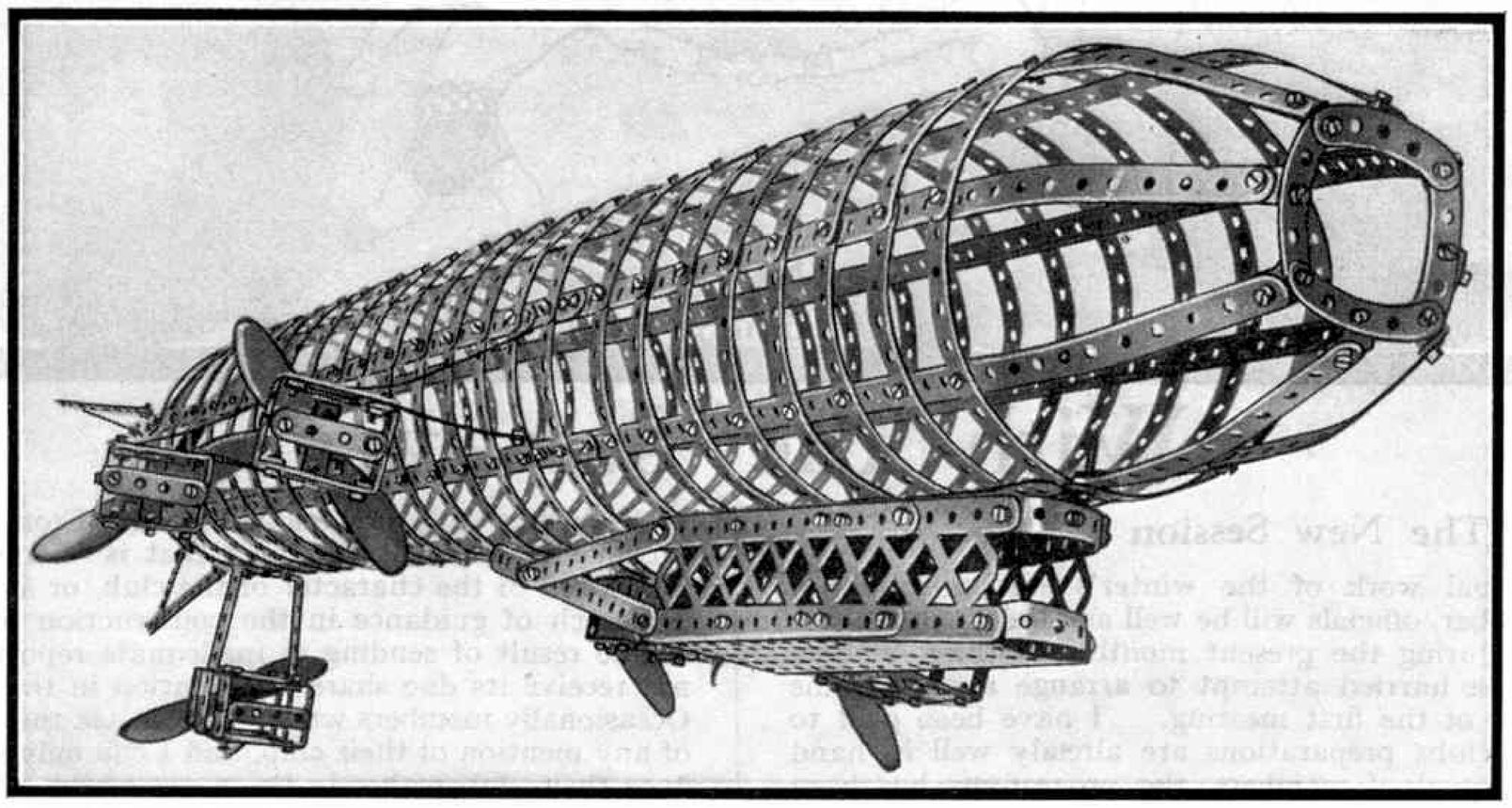
Nisbet's entry secured priority, however, chiefly on account of its neat appearance. Neatness always counts a great deal and a neat model will sometimes carry off a prize even if it is not the most original in design or construction. To produce a really neat appearance a sound knowledge of the uses of the various Meccano parts is absolutely essential and for this reason alone great importance is attached to the presence of this quality in all prize winning models. A pleasing feature of Nisbet's model is the fitting of the brakes, operated by a Screwed Rod passed through a Threaded Boss, and arranged so that rotation of the Screwed Rod either applies the brake shoes to the wheels or withdraws them, according to the direction of rotation of the Threaded Rod.

Turning now to a more modern and speedier form of propulsion, a glance should be taken at the Meccano model airship produced jointly by two Swiss boys, Otto and Robert Tondury. There has recently been a revival of the controversy as to the relative merits of the airship and the aeroplane for long distance voyages and additional interest is lent therefore to this prize-winning entry. Although the model is not intended to represent any particular airship, it reminds me of the frequent remark made by visitors to the shed where one of these great vessels was under construction: "How like a huge Meccano model!"

In regard to the constructional details of the model, the photograph shows clearly the manner in which the various portions are built and assembled. Unfortunately the designers have not included motors for operating the propellers. The shape of the envelope is reproduced excellently, although it is perhaps a little blunt at the nose! The passenger car and engine gondolas are much too large in proportion, however.

Mechanical excavating appliances of all types are usually favourite subjects with competitors and it is therefore not surprising to find Jack Southern's mechanical shovel among the prize-winners. For general neatness of appearance and structural design the model is certainly a "winner." Although Southern has followed accepted principles generally in designing his model, he has nevertheless succeeded in building a very interesting excavator and one which I am sure most Meccano boys will agree to be worthy of the Third Prize.

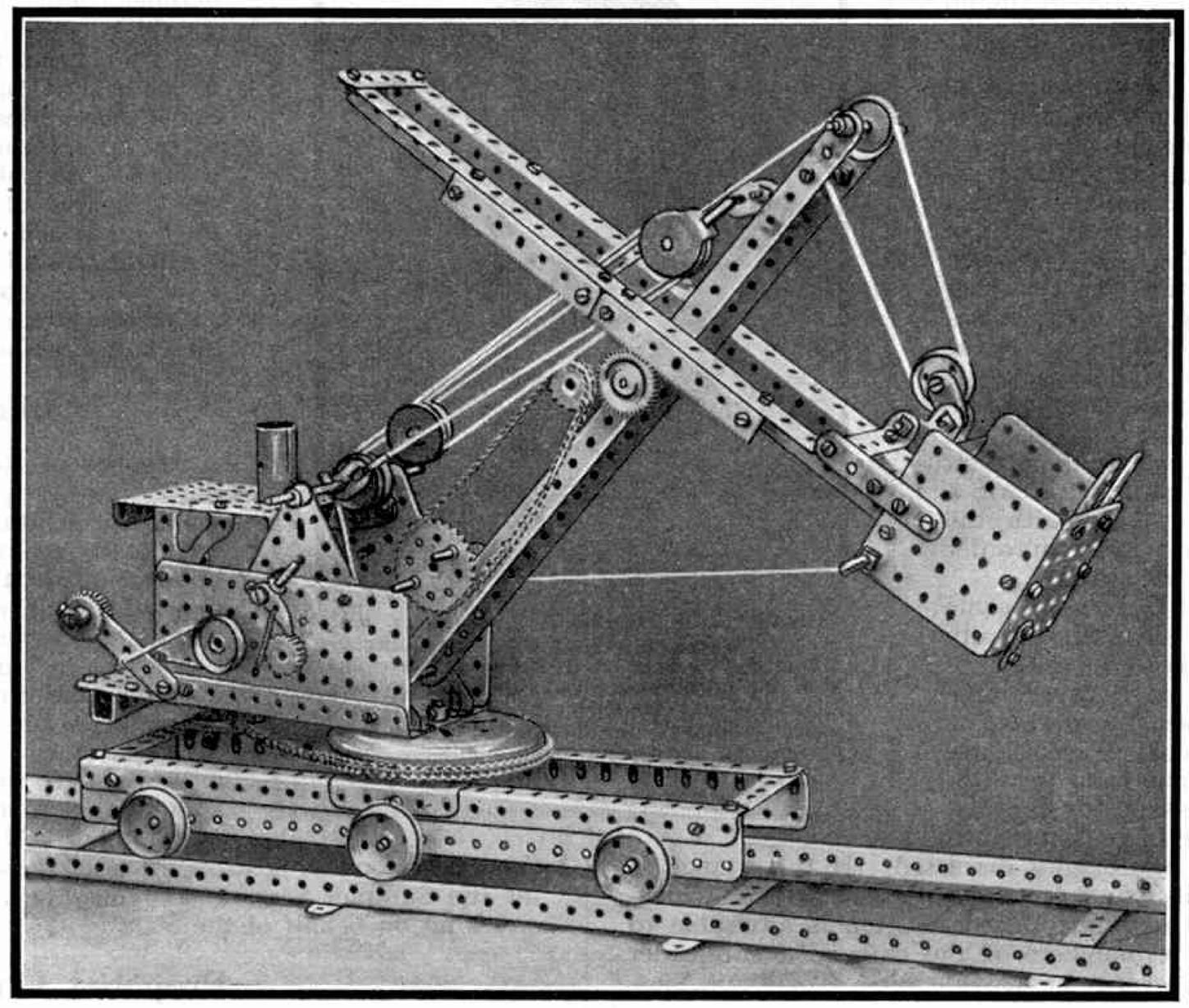
Its main structural features are shown quite clearly in the photograph. The superstructure revolves on a Meccano Ball Bearing, the lower Race of which is secured to the travelling under carriage. It will also be noticed that the jib is pivoted—a feature that does not always appear in excavators of this type. In some cases the jib is rigid and cannot be raised or lowered, all the work being carried out by sliding the bucket arm inward or outward and so altering the radius of the working area to suit the nature of the particular ground or material on which the machine is operating.



A well designed example of a Meccano airship constructed jointly by two young Swiss boys, Robert and Otto Tondury, of Zurich, who have been awarded the Second Prize

The fine model of a fifteenth century "carack" entered by Ernest Smith is a fitting testimonial to his skill and ingenuity and shows plainly that he has an excellent knowledge of how to obtain the best results from a limited number of parts. The details of these mediæval sailing ships are not easy to reproduce, and Smith is therefore to be congratulated on having managed to turn out a very complete and interesting model.

The carack type of vessel was very popular at the beginning of the sixteenth century and it is probable that even earlier than this, large numbers of them were sailing the seas. Most of the caracks existing between 1490-1540 were built on the three-masted principle, the fore and main masts carrying a large square sail and a very small top sail, the mizen hoisting a lateen, and a sprit sail on the bowsprit.



Jack Southern's prize-winning Mechanical Excavator

Although it has not been possible to illustrate Smith's model in this issue a brief description of it should nevertheless be of interest. The hull is composed of a number of Flat Girders and Strips ingeniously arranged to conform to the graceful lines of the prototype. The decks are formed with a number of Flat Plates and two very realistic looking hatches have been constructed from Flanged Plates. Enclosed in the hull is a string of small electric lamps of the type commonly used for Christmas tree decorations. Similar lamps have also been made to serve both as bow and stern lanterns. Stout white paper is used for the sails and these give the model a very striking appearance, especially when it is viewed in a darkened room with the faint glow from the electric lamps in the hull gleaming on the folds of the imitation canvas. By using Washers for pulley blocks a final touch of realism has been given to an altogether excellent piece of workmanship.

Another interesting entry was that received from William Welsh, who submitted a fine representation of a travelling crane. The model is capable of the three movements of swivelling, travelling and luffing in addition, of course, to the hoisting and lowering of the load.

The travelling, swivelling and luffing operations are controlled from a common handwheel, which is placed in a convenient position at the rear of the model and consists of a Pinion ($\frac{1}{2}$" wide) secured to a Rod. The latter is passed through holes in the Motor side plates and carries a Bush Wheel on one of its ends. This Bush Wheel is connected by a $1\frac{1}{2}$" and a $4\frac{1}{2}$" Strip to the Rod on which the luffing cord is wound, and the result of the arrangement is that partial rotation of the handwheel causes the luffing Rod to slide, thus throwing it in or out of engagement with the main gear box.

The travelling movement is brought into action by pulling on the control handle, which causes the web of a Crank secured to the Rod of the handle to impart a sliding movement to the driving Rod connected with the travelling wheels. This movement brings a $\frac{3}{4}$" Pinion that is secured to the Rod into mesh with the gears of the main gear box, which, through the medium of a simple gear train, causes the travelling wheels of the model to be rotated.

The superstructure is rotated by engaging a $\frac{1}{2}$" Bevel Gear with a $1\frac{1}{2}$" Bevel that is secured on a short vertical Rod. On its other end, this Rod carries a $\frac{1}{2}$" Pinion engaging with a $3\frac{1}{2}$" Gear Wheel that is secured to the base. Rotation of the $\frac{1}{2}$" Pinion will thus cause the superstructure to be driven round about the base of the model.

With the Secretary

The New Session

Although the actual work of the winter's session may not commence until October, officials will be well advised to commence active preparations during the present month. Nothing hinders progress more than a hurried attempt to arrange a programme within a day or two of the first meeting. I have been glad to note that in many clubs preparations are already well in hand and, subject to approval of members, the programme has been almost completed.

During the summer Leaders and Secretaries have had time to think over the experiences of last winter and to remedy defects and plan improvements in the programmes that were then followed. Looking back in this manner it is easy to determine the type of meetings that were most favoured by members, and of course, those that made the widest appeal should form the basis of the programme for the coming session.

On this point I wish to say a word of warning. It has frequently happened that a Club has introduced a new feature which, for some reason or other, has become exceptionally popular. In consequence, this feature has been given a great deal of prominence in the subsequent session, in some cases to the exclusion of other features of long standing. The result has been that members got too much of the new feature and tired of it, and subsequently the whole syllabus became disorganised. The moral is to avoid overloading a syllabus with any one feature however popular it may be at the moment, and to secure a wide range of items, not only with the object of ensuring variety, but in order to respect the wishes of minorities.

At the first meeting of the session some time should be devoted to settling finally the programme to be followed. The submission by the Leader of a programme based on the previous year's working, as already suggested, modified in accordance with any new ideas they may bring forward, will give an excellent start to the discussion. Means for putting them into practice then should be thoroughly discussed. If the change is only a small one the details may be settled with very little difficulty, but if a new hobby is to be introduced it often is advisable to appoint one of the senior members of the club as a sub-leader to make the necessary arrangements.

Value of Good Reports

There is a remarkable difference in the quality of the reports sent in by secretaries. From one official I may receive a concise but complete account of every meeting, in which the activities of the members are explained, and in addition, a few notes on any events of special interest are given. From another comes a mere list of dates accompanied by one or two words to show that the time was devoted to model-building or to a lecture. Reports of the latter kind are really useless. From them it is quite impossible to make up a report that is of any value, either as an indication of the character of the club, or as a help to other clubs in search of guidance in the construction of a programme.

One result of sending in inadequate reports is that a club does not receive its due share of attention in the "Club Notes" page. Occasionally members write to me to ask the reason for the absence of any mention of their club, and I can only reply that the appearance their club makes in the pages of the "*M.M.*" is very largely a measure of the efforts of the secretary.

I particularly wish secretaries to remember that each Club report is examined with special attention by all "*M.M.*" readers who live in the neighbourhood of that Club. These readers include many possible recruits who may be induced to join if the reports show that the Club is being carried on in a bright and attractive manner. For this reason alone no effort should be spared to send in good reports, and I hope that there will be a considerable improvement in this respect in future. Some secretaries make a point of writing to me at intervals in addition to sending in their monthly reports. These letters are a source of great interest to me, and they often contain valuable suggestions. I should like all secretaries to realise that I am always glad to hear from them and to receive their views on any aspect of Meccano Club activities.

Meccano Club Leaders

No. 40. Mr. T. O. B. Moreton

Mr. T. O. B. Moreton is joint Leader, with Mr. H. Drakes, of Winchmore Hill Collegiate School M.C. Since its affiliation in November 1925, the members of this club have been keen Model-builders. Recently they have made a special feature of the building of model aeroplanes, and several successful miniature flying meetings have been held.

Guild Literature

Supplies of Report Forms, Membership Cards, Subscription Cards, and Guild Application Forms are now available, and secretaries are requested to make early application for them. The beginning of a new session is an ideal time for a little recruiting campaign, and I shall be very pleased to include with the above supplies of the leaflet that explains the aims and organisation of the Guild.

* * * *

I wish to remind Leaders that they should send in their recommendations for special Merit Medallions for the Summer Session as soon as possible. Two of these are allotted to each club for the Summer Session, and may be awarded for good work of any kind on behalf of the club.

Proposed Clubs

Attempts are being made to form clubs in the following places, and boys interested should communicate with the promoters whose names and addresses are given below:—

DONCASTER—V. C. Hunt, 115, Wentworth Road, Wheatley.
INDIA—Mr. K. Singh, 6, Nisbet Road, Lahore, Punjab.
LONDON—N. Sneddon, 26, St. James' Square, Holland Park.
MANCHESTER—A. Gregory, Saxon Farm, Audenshaw.
MANCHESTER—I. Shepherd, 32, Carlton Street, Old Trafford.
NEW ZEALAND—Mr. D. Cox, 200, High Street, Christchurch.

CLUB NOTES

Exning (Newmarket) M.C.—Interesting Cycle Runs have been held and Cricket Matches are being played regularly against local clubs. A large model is to be made of a newly-constructed bridge seen on one of the Cycle Runs, and of which careful drawings were made. A Sports Meeting has been held, events being keenly contested. Club roll: 13. *Secretary*: Miss S. Payne, Red House, Exning.

Albert Village M.C.—A Senior Section has been formed, and has resulted in a large increase in membership. The Junior Cricket Team has won eight out of 15 Cricket Matches played, while the Seniors have played four matches and won three. At the Summer Exhibition the models included the Meccanograph, Revolving Crane, Motor Cycle and Sidecar, Autogyro, Waterwheel and Windmill, and a large Hornby Train Layout. Club roll: 36. *Secretary*: L. C. Adey, 239, Occupation Road, Woodville, Burton-on-Trent.

Borden Grammar School M.C.—Has now moved to its new club room at the School. Excellent models constructed by groups of members are an Omnibus, a Ship, and a Motor Chassis. The mechanism of the Motor Chassis is being made as complete and realistic as possible. Mr. W. Murdoch, M.A., the President, visited the club to present certificates and gave an address that greatly stimulated the enthusiasm of members. Club roll: 51. *Secretary*: H. Rivett, 48, Ridham Avenue, Kemsley, Milton Regis, Kent.

Chertsey M.C.—Members were divided into two sections for a Model-building Competition in which a Fire-escape was to be constructed. A time limit was set and the models were then judged by adult visitors. Lectures have been given on "*Boots*," by Mr. Du Cros; "*First Aid*" by the Leader; and "*Simple Machines*," by Mr. Bloyce. Several enjoyable Rambles and Picnics have been held. Club roll: 21 *Secretary*: V. Brown, Arbon Grove Cottage, Lyne, Chertsey, Surrey.

Royal Grammar School (High Wycombe) M.C.—The Meccano Club Section was the central attraction of the Exhibition held on Speech Day. Special interest was taken in a Ship Coaler and Roundabout, on loan from Headquarters; an ingenious Penny-in-the-Slot, Bagatelle Board, and a model of a Flying Boat Roundabout, the last two being constructed by members of the club. The principal speaker and guest on Speech Day was Dr. James, Provost of Eton, who showed great interest in the exhibits. Club roll: 170. *Secretary*: T. W. Earis, 18, Dashwood Avenue, High Wycombe.

Fulstow Junior M.C.—A Tennis Tournament was won by the Leader after a great struggle, and an exciting Treasure Hunt and Cricket Matches have been other summer recreations. A Fishing Match was greatly enjoyed by members although a few bites were the only reward of an hour-and-a-half's patience. A successful Garden Party was held in order to raise funds for carrying out desirable improvements to the club room. Club roll: 13. *Secretary*: L. W. Doe, The Stores, Fulstow, North Thoresby, S.O. Lincs.

Halifax M.C.—At one meeting the article on "*Laying a Telephone Cable Across the Baltic*" that appeared in the April 1929 "*M.M.*" was read, and was followed by a talk on the wrapping and insulation of cables. During the summer, meetings usually have taken the form of short Rambles to local places of interest. Club roll: 10. *Secretary*: H. Ramsbottom, 155, Warley Road, West End, Halifax.

Westbury M.C.—Visits have been paid to the Henlow Aerodrome, where members were allowed to sit in the machines in order to see how they are controlled; and also to a large farm dairy, where they inspected modern milking machinery. Club roll: 35. *Secretary*: E. D. Moye, 24, Burnell Rise, Letchworth.

Weymouth Central School M.C.—At one meeting every member constructed a model of a motor car, which was criticised and judged by the other members. Games in the club room—which is called the "Gear Box"—and in the hills are arranged regularly. One interesting game is "Lamp Raiding," in which two members guard a lighted lamp set on the ground from the attacks of members who steal up in order to blow it out! Three tents were erected to form the Club Camp, and all were filled during the camping season. A discussion on "*Railway Posters Seen from an Engineering Point of View*" was unexpectedly interesting. Club roll: 27. *Secretary*: A. H. Brake, 2, Charles Street, Weymouth.

Wimbledon M.C.—A Debate on "*Electricity v. Steam*" led to an interesting exchange of views, and the voting ended in a draw. The club assisted at a Garden Fête in aid of local charities by exhibiting and demonstrating working models built by members. Lectures on "*The Tourist Trophy Races*" and "*Electricity*" have been given. Club roll: 23. *Secretary*: M. O'Carroll, "Dairin," Drax Avenue, Wimbledon, S.W.20.

The Fulstow Junior M.C. was affiliated in February of this year, and has made excellent progress under the energetic leadership of Mr. W. R. Phillips, who is seated in the centre of the group. The club specialises in large models, which are built and assembled in the most realistic manner

Pershore M.C.—A splendid display of models was made in connection with the local Flower Show. Included among them was a Transporter Bridge on loan from Headquarters. A large Hornby Train Layout also was constructed for this event, and members practised running trains to a timetable, with the result that no hitch occurred in the working. Club roll: 21. *Secretary*: D. Cross, Knight's Villa, Church Street, Pershore.

Whitgift Grammar School M.C.—The Exhibition at the end of the School term was highly successful. Models on view included Motor Chassis, Traction Engine, Naval Quick-Firing Gun, Steam Navvy, and Big Wheel. A novel feature was a display of drawings by members of famous locomotives. Demonstrations of the working of various models were given at intervals. The club was highly complimented on the display by the Headmaster. Club roll: 38. *Secretary*: R. T. Furlong, 49, Kilmartin Avenue, Norbury, S.W.16.

Gaywood M.C.—A paper on "*Aeroplanes*" read by a member proved very interesting. A Model-building Competition has been concluded, the prize being a fountain pen. Club roll: 10. *Secretary*: H. J. Bird, "Gaywood," Park Road, Solihull.

Ashby Grammar School M.C.—A visit to the works of J. Woodward Ltd., where pipes and other earthenware articles are made, greatly interested members. Other places visited include a Quarry and By-product Distillation Plant, the Co-operative Dairy at Burton, and the St. Bernard Monastery at Coalville. A talk on "*Photography*" by the former Leader, Lantern Lectures, and Papers by members also have been given. Club roll: 50. *Secretary*: R. W. T. Moore, "Summerfield," Wilmot Road, Swadlincote, Burton-on-Trent.

Newcastle M.C.—Is still without a club room. It has been proposed to purchase a hut for the joint use of the club and the local branch of the H.R.C. For this purpose a fund has been started, and an Exhibition is to be held in October to give this a good start. Club roll: 32. *Secretary*: K. Mark, 445, Chillingham Road, Heaton, Newcastle-on-Tyne.

Sedgley Park M.C.—Now possesses a No. 5 Meccano Outfit, which has been kindly presented by one of the members. The club already has an excellent model railway with track mounted on trestles, and it is proposed to form a branch of the H.R.C. Membership is growing rapidly and the secretary would appreciate assistance in finding a larger club room. A small prize is now awarded to the member with the best attendance record. The Sports Meeting was very successful, 12 events being keenly contested. Club roll: 16. *Secretary*: W. A. Robinson, 9, Queens Drive, Sedgley Park, Prestwich, Manchester.

St. Saviours (Faversham) M.C. — Members visited Lloyds Paper Mills, where they were specially interested in the paper-making machine itself, and also in the Generating Plant and an Overhead Crane. Active preparations are being made for the Exhibition, when a large display of models will be made and the Meccano play "*Nonsense Nana*" presented. Club roll: 12. *Secretary*: A. H. Gregory, 39, East Street, Faversham.

Wallingford County Grammar School M.C.—The President of the Club, Mr. J. Moody, Headmaster of the School, gave an interesting Lecture on "*Experiences in India during the Great War.*" The Exhibition arranged for the end of the term was very successful. Excellent Meccano models and a large Hornby Train Layout were displayed, and in addition, Fretwork and photographs taken by the members of the Photographic Section were on view. Club roll: 12. *Secretary*: L. M. Allen, Rosemead, The Moors, Pangbourne, Berks.

Egypt

Sphinx (Cairo) M.C.—A Stamp Section has been commenced and regular talks on stamps are being given in order to assist beginners. The Leader gave a very interesting talk on "*Engineering Work in Building the Great Pyramids.*" Photography is a favourite hobby with members, the Photographic Section being under the leadership of the club secretary. Interesting excursions have been made to local factories. Club roll: 16. *Secretary*: A. H. A. Abdel-Moném, 2, Haret El Ismaily, Nasria, Cairo.

New Zealand

Dunedin M.C.—Celebrated its third anniversary by a Social Evening, at which the Leader (Mrs. MacLachlan) kindly supplied refreshments. Frequent Model-building Competitions have been held together with Contractors and Hornby Train Nights. An interesting Competition was arranged for Model Drawing, entries being judged chiefly on their usefulness to model-builders. Club roll: 8. *Secretary*: T. MacLachlan, Art Studio, 66, Albany St., Dunedin, Otago, New Zealand.

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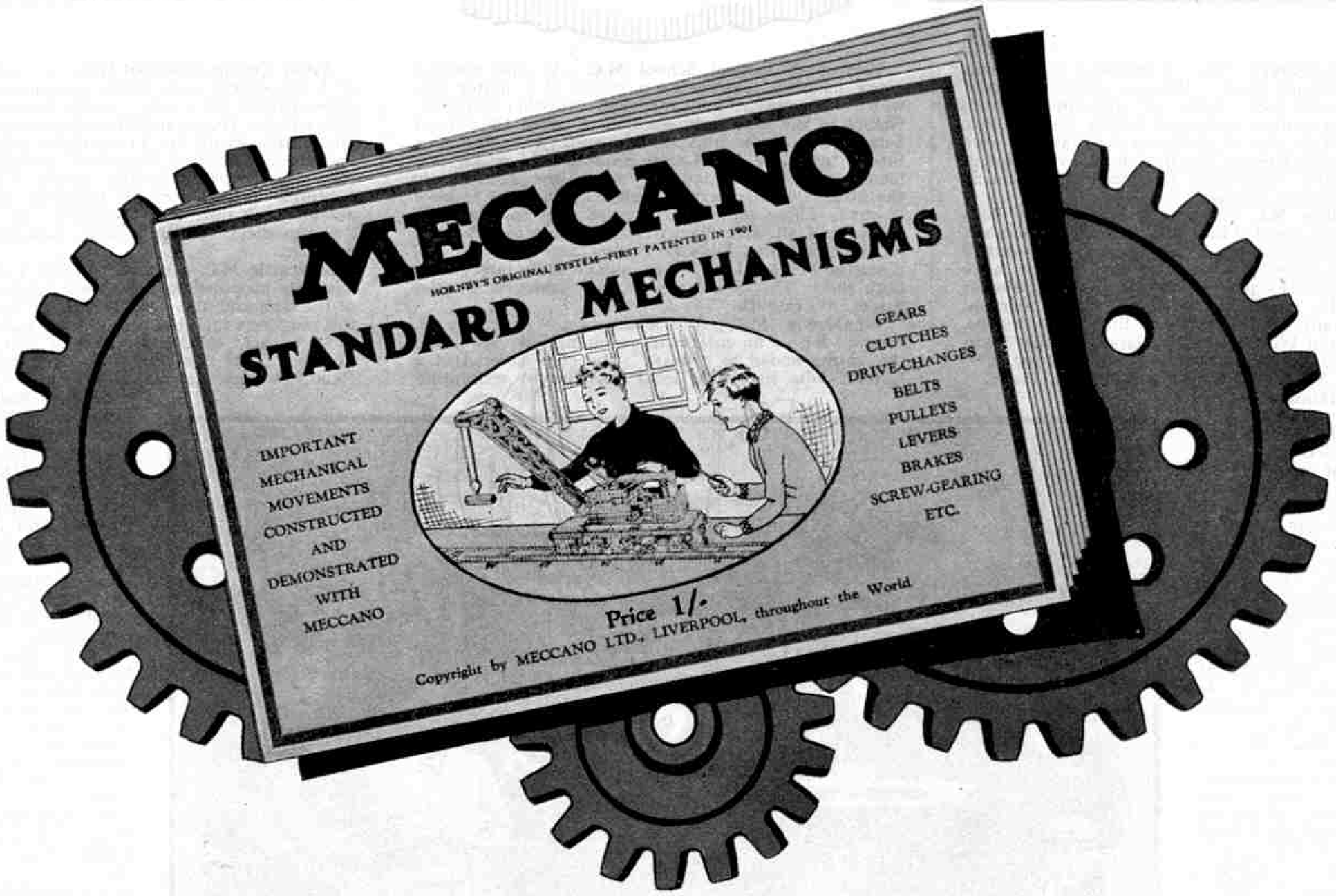

The great development of the Meccano system during the last few years has made possible a large number of new mechanisms and movements, and it has been necessary to bring the Meccano "Standard Mechanisms Manual" up-to-date. We have pleasure therefore in announcing the publication of a new and revised edition.

The new Meccano Standard Mechanisms Manual is full of information that is invaluable to every keen Meccano model-builder. It deals with gear boxes, clutches, drive-changing mechanisms, belt and pulley mechanism, levers, brakes of all types, screw mechanisms and a large number of other movements.

Considerable space is devoted to particulars of the many new mechanisms that can be devised with the aid of the new Socket Coupling, elongated Pinions, and Bevel Wheels, etc. The uses of the new Roller and Ball Bearings are also dealt with fully. In addition, electric braking and governing devices have been included, and these form valuable additions to the range of existing mechanisms. The book contains over a hundred beautiful half-tone illustrations, which greatly simplify the construction of the more complicated movements.

HOW TO OBTAIN THE MANUAL

The 1929 Meccano Standard Mechanisms Manual may be obtained from any Meccano dealer, price 1/–, or direct from Meccano Ltd., Old Swan, Liverpool, price 1/1½ post free.

There is a special edition for Overseas, price 1/6 from dealers or 1/8 post free, from the agents (Canadian price 35 cents from dealers or 38 cents post free, from Toronto).

Readers in Australia, New Zealand, South Africa or Canada who require copies should apply to their dealers or should address their orders to our agencies as detailed below. Readers living in countries other than those mentioned should order from Meccano Ltd., Old Swan, Liverpool, sending a remittance of 1/1½ with their order.

Australia : E. G. Page & Co., 52, Clarence Street, Sydney. (P.O. Box 1832).

New Zealand : Models Ltd., Kingston Street, Auckland. (P.O. Box 129).

South Africa : Arthur E. Harris, 142, Market Street, Johannesburg. (P.O. Box 1199).

Canada : Meccano Ltd., 45, Colborne Street, Toronto.

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Competition Page

"Meccano Figureword"—A Novel Puzzle

This month we are introducing a novel type of contest that we feel sure will prove very popular with our readers. To it we have given the name of "*Meccano Figureword*" and, as its name implies, it resembles a crossword puzzle. Perhaps the best description is that it is a "crossfigure" competition that is based on the names of Meccano parts.

A glance at the diagram on this page will make the new competition quite clear. Into each of the blank spaces shown a letter must be inserted and, when read horizontally, these should form the names of Meccano parts. To each letter of the alphabet is assigned a number. Thus to A is given the value 1; letters B and C are represented numerically by 2 and 3; and so on, down to letter Z, which is the twenty-sixth letter in the alphabet, and is therefore given the value 26. Competitors are asked to find names of Meccano parts in which the numbers assigned to the letters add up to the totals shown in the right hand column. At the same time the numerical values of the letters appearing in each of the vertical rows must on addition give the numbers at its foot.

C	O	L	L	A	R	S	80
							96
							75
							102
							87
							80
82	66	83	51	57	67	114	HORIZONTAL TOTALS
TOTALS IN VERTICAL COLUMNS							

The names of the parts that form the solution are all composed of seven letters and, therefore, no blanks may occur in any of the squares. An additional difficulty is introduced by the fact that letters in the names of different Meccano parts may add up to the same total. One instance of this appears in the puzzle, where it will be noticed that the totals of the first and last rows are identical. Competitors must be on their guard against assuming without proof that the same word occurs twice in the solution. They also should note that names may be used in the singular or in the plural.

In solving a figureword much time may be wasted in making a correct start, and we have provided competitors with an additional clue in the form of the letter occupying the first square. This is C and, of course, its numerical value is 3.

In entering for this puzzle contest, readers should not cut the design from the page. This should be copied on a sheet of paper, and the solutions then worked out.

Prizes of Meccano Parts or Hornby Train Accessories (to be chosen by the winners) to the value of £1/1/–, 15/–, 10/6 and 5/– will be awarded to the senders of the first four correct solutions in the order in which they are opened on the morning following the closing date. In addition there will be a number of consolation prizes. Entries must be addressed to "Figurewords, Meccano Magazine, Binns Road, Old Swan, Liverpool," and should reach this office not later than 30th September. Overseas, 31st December. The competitor's name and address must appear on the back of each sheet of paper used. Entries not complying with this rule will be disqualified.

1929 Cricket

Before this issue of the "*M.M.*" has run its life the 1929 Cricket season will have ended, and for the cricket enthusiast there will be left nothing but retrospect.

As we sat in a cricket pavilion a week or so ago we listened with intense interest to a discussion of outstanding personalities of the game, and particularly of the season. Bowlers, batsmen, stumpers, and all-rounders came under review. Woolley's test-cricket "come back," Geary's record-making 10 for 18 against Glamorgan, Duckworth's ability with the bat, and a score of other names and feats were recounted. As we listened we thought how interesting it would be to have the mass opinion of the cricketing readers of the "*M.M.*" as to the "OUTSTANDING CRICKETER OF THE SEASON NOW ENDING."

Accordingly we offer prizes for the best brief opinions on this very debatable topic. Readers may choose a bowler, a batsman, an all-rounder or a stumper and, in a 250-word statement, outline their reasons for their choice.

Prizes of Meccano products to the value of £1/1/– and 10/6 respectively are offered for the best and second-best entries in each of the two sections into which the competition will be divided. A for those aged 16 and over. B for those under 16. Entries must be written on one side of the paper only, and only the competitor's name, age, and address may appear on the back of each sheet used.

Entries must be addressed to "Cricket Opinion, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must be sent to reach this office not later than 30th September. Overseas closing date—31st December.

RESULTS—Home

Jamboree Contest.—The number of bolts deposited in the sidecar of the Meccano model motor-cycle combination shown in the window of the Meccano shop at the Jamboree, was 1,002. The first accurate entry was submitted by Mr. Robert Cooper, 104, Hunter House Road, Endcliffe, Sheffield, to whom the model combination has been despatched as a souvenir of his success.

Overseas

Stepwords.—The popularity of the Stepwords Contest at Home has been echoed very strongly by our Overseas readers. But the Overseas competitors have scored heavily on this occasion, for whereas no Home entry was perfectly correct, each of the four Overseas prize winners has submitted a completely accurate solution! In consequence we have been compelled to award the prizes on the basis of neatness and novelty of presentation, in accordance with our custom in such circumstances.

The successful entrants' names are as follows:—1, B. W. MONK (Knightsbridge, S.A.); 2, J. A. RODRIQUEZ (Montreal); 3, B. K. CHOKSI (Karachi); 4, H. C. KEY (Siraggany, India).

For the benefit of those competitors who wish to check their entries the solution is appended:—1. Pun, Nun, Nut, Tub, Bud, Dud, Dub, Bun, Nub; 2. Lot, Top, Peg, Gay, Yew, Wit, Tie, Elf, Fag; 3, Err, Era, Tea, Top, Tip, Tot, Pot, Tip, Sap; 4, Bay, Beg, Fig, Fop, Tup, Taw, New, Nib, Fob.

39th Photographic Contest.—The subject in this competition was "An Easter Photograph," and our Overseas readers made full use of the wide scope afforded. Some exceedingly interesting photographs were submitted, notably that from N. F. Keith which shows a walking tourist making a perilous crossing of the Collingwood River in the Tasmanian Bush. The method of transit consists of walking on one slack rope while holding on to another.

In the space available it is impossible to deal fully with the entries, but at a later date we hope to reproduce some of them. The awards were as follows:—First Prizes: Section A, N. F. KEITH (Geelong); Section B, H. N. EUSTIS (Alberton, S.A.); Second Prizes: Section A, F. VAN BULCK (Antwerp); Section B, J. TANNER (Sydney). Consolation Prizes: L. W. LUTZ (Adelaide); R. PARNELL (Malta).

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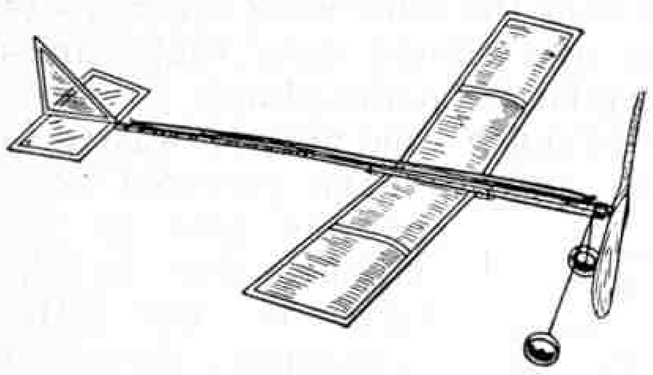

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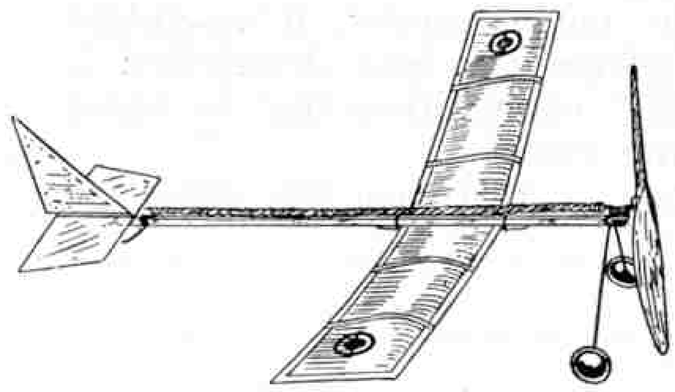

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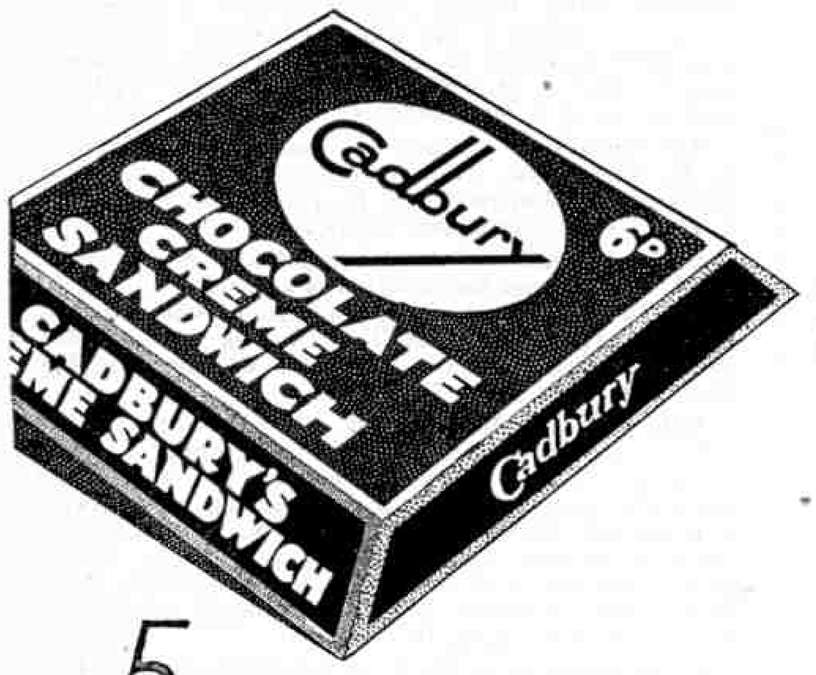

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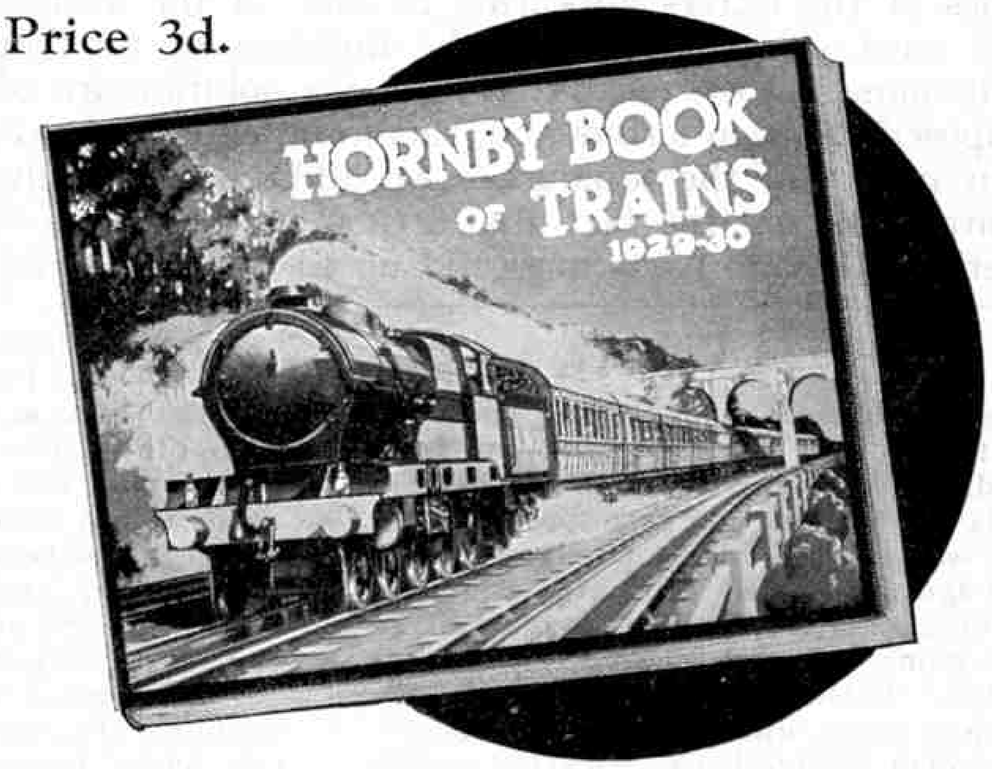
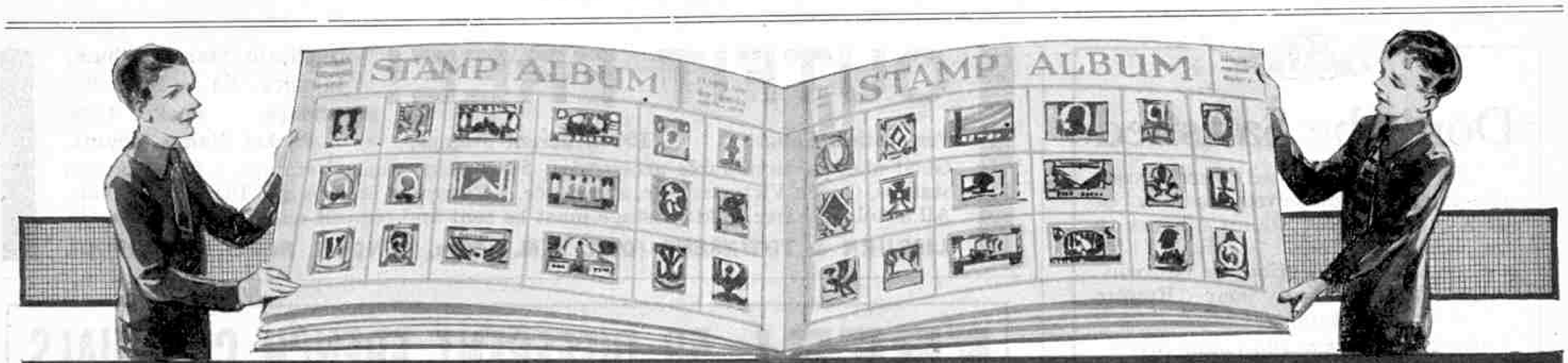


The Hornby Book of Trains has come to be regarded as an annual event, and those of our readers who have found boundless fascination in the past issues will be happy in the knowledge that the 1929-30 edition is now in active preparation. It will eclipse in every way even the well-merited success of its predecessors.

The publishing date will be the 16th November, and as there will undoubtedly be a big demand, we advise every Hornby Train enthusiast to make certain of his copy by ordering NOW from your Meccano dealer.

A further important announcement regarding this book and its contents will be made in the October number of the "*Meccano Magazine.*"

MECCANO LTD. OLD SWAN LIVERPOOL



STAMP COLLECTING

HISTORY IN THE STAMP ALBUM

ALL stamp collectors, whether beginners or experts, realise that the history of the civilised world since the introduction of stamps may be traced in their collections. Until 1914 this historical interest was largely confined to changes of monarchy, the accession of a new king or emperor naturally being followed by the issue of new stamps. On rarer occasions there were also sudden changes or revolutions that led to the production of new and interesting stamps, but all previous records of this kind have been surpassed during the years since the outbreak of the Great War.

A complete collection of stamps issued since 1914 would be very extensive. An album containing it would practically be a guide book to history, for it would remind its owner of practically every event of importance and also of many minor happenings that now are almost forgotten. For instance, how many people still remember that in 1918 a Siamese Expeditionary Force left for Europe? Collectors who possess a Siamese stamp specially overprinted at that time with a Red Geneva Cross are almost the only people who have not forgotten this interesting event, of which they also are reminded by the existence of a series of stamps of the same country over which the word "*Victory*" is printed. The overprint is in English and Siamese.

Overprinting has always been a favourite device for devoting a stamp issue to special purposes. Readers no doubt are familiar with stamps of British colonies and dominions on which the words "*War Tax*" or "*War Stamp*" have been overprinted. This draws their attention to the practice followed in many countries during the War of increasing postal charges in order to bring in extra revenue. An excellent example is the green 1 cent Canadian stamp illustrated on this page. The presence of stamps of this class in collectors' albums may prove a deterrent to future wars, for they help to bring home the fact that wars are luxuries that must be paid for!

Another reminder of the difficulties caused by the War is given by the numerous charity stamps issued by European States in which distress was rampant. The first illustration to this article is a very interesting example of a stamp of this kind. It is a brown 60 filler Hungarian stamp, and the inscription at the bottom shows that on it there was a premium of two korona. The purpose to which the extra charge was to be devoted is well indicated by the pathetic picture on the face of the stamp of prisoners of war confined by a formidable barbed wire fence. The prisoners shown are, of course, Hungarians, and the stamp was issued for the special benefit of natives of that country who had been captured on the Eastern Front and consigned to the rigours of a Siberian winter.

An interesting issue of charity stamps was made in France in 1926, and one of these is the 50c. stamp illustrated on this page. The premium of 10c. was collected for the support of French war orphans. This stamp is a painful reminder of the fact that war brings misery in its train, not only for the vanquished but also for the victors.

Although war tax and charity stamps are full of interest, the Great War brought with it many changes that led to the issue of stamps of greater importance. The changes in old countries and the rise of new states in the years following the Armistice have been very complicated, and it is no exaggeration to say that they may most easily be traced by a careful examination of stamps issued during that period.

The change from the Imperial Russian Empire to the Union of Soviet Republics may be followed in this manner. The last stamps issued of the late Czar were overprinted on the back in order to make them legal currency when ordinary coins were scarce, and many of them were issued by the first Revolutionary Government. A new stamp issue also was planned in order to mark the changed conditions, but the task of issuing this fell into other hands, for before it was introduced a further revolution brought the Bolsheviks into power.

From 1918 to 1921 no stamps of any kind were produced, the Soviet Government having abolished them in order to make the posts free. Since 1921, however, an extensive series of stamps of all kinds has appeared. These include charitable and commemorative stamps, in addition to those designed for ordinary postal use. From a historical point of view the most interesting are those on which appears the portrait of Lenin, the founder of modern Russia. The violet 5,000 rouble stamp illustrated is not one of these, but is typically Russian. It was issued in 1922 and is symbolic in character, the design being suggestive of the crafts and industries of a modern state.

A curious feature of this stamp is its large nominal value. A similar stamp issued at the same time actually had the nominal value of 22,500 roubles! At pre-war rates this would have been equivalent to about £2,400 in our money. This did not necessarily mean that the stamp was very valuable, but showed only that the rouble had lost almost all its value in international currency dealings.

Perhaps the most

(*Continued on page 741*)

Don't be Satisfied

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With these we will send you a **FREE** STAMP OUTFIT, comprising Packet of 75 all different STAMPS, 100 STAMP HINGES, 12 Page Duplicate ALBUM and a pair of **OXYDISED STEEL TWEEZERS.** (2d. Stamp required for packing and Postage. Overseas 4d. Stamp).

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The Belgians are honouring England's great Explorer, H. M. STANLEY (to whom they owed so much for his work on the Congo) with a special issue of stamps bearing his head. I am therefore offering a packet of *African Stamps only,* representing most of the countries he explored and the adjoining States. ALL are GOOD CLASS STAMPS. NO COMMON Continentals. GOLD COAST, NIGERIA, PORTUGUESE CONGO, a fine set of KENYA & UGANDA, MIDDLE CONGO, EQUATORIAL AFRICA, QUILEMANE (ZAMBESIA), IVORY COAST, RUANDA-URUNDI, RHODESIA, NIGER, ANGOLA and many others. Price 4½d., postage 1½d. extra. In addition to this I am presenting all who ask to see my approval sheets a SPLENDID set of **10 CONGO** (including the Stanley Stamps) usually sold at **1/–.** Senders of addresses of stamp-collecting friends will receive a free set in addition. List of 700 sets and packets **1d.** extra.

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To meet the needs of both GENERAL and SPECIALIST COLLECTORS I am giving BOTH THESE PACKETS FREE

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Including Obsolete Pictorial Values (**Mount Houllemont, Gustavia Bay,** etc.), also fine **new issue** showing interior of **Sugar Cane Factory, Avenue of Palms,** etc. This attractive gift will be sent **absolutely free** to all stamp collectors sending 1½d. postage. Only one gift to each applicant. (Abroad 2½d.).

G. P. KEEF, Mortimer Lodge, Wimbledon Park, London, S.W.19.

For further Stamp Advertisements, see also page 752

Stamp Collecting—(*Continued from page 739*)

interesting of the new States that came into existence as a result of the Great War is Czecho-Slovakia, one of the countries carved out of the old Austrian empire. It includes Bohemia and other provinces, the natives of which retained their Czech or Slovakian nationality in spite of being under German rule for centuries. The orange 60 heller stamp illustrated is a typical Czecho-Slovakian stamp. It appeared in 1919, only six months after the Revolutionary Committee of Prague had issued the first Czecho-Slovakian stamp. The driving force behind the establishment of the Czecho-Slovakian Republic was Professor Masaryk, who had many associations with this country, and his portrait appeared on later stamps issued by the Republic.

In many respects the history of Italy after the War is as interesting as that of any country. In Russia the conflict led to the triumph of Socialistic ideas. At one time there appeared the possibility that this also would be the case in Italy, but in the end the exact opposite occurred, and the Fascists under their able and determined chief, Benito Mussolini, united the Italian people into a progressive and well-ordered nation. The 5 lire stamp illustrated is one of a special issue that appeared in 1923 in commemoration of the triumph of the Fascisti. It is bold in design, and leaves no doubt of its origin, for on each side may be seen the bundles of rods, or fasces, bound round an axe, from which the name of the modern movement was taken. These rods were carried before the higher magistrates of ancient Rome as a symbol of authority.

An interesting sidelight on Italian history is given by the 1 lira Fiume stamp—also illustrated. The impressive head figured on it is that of Gabriele d'Annunzio, the poet and dramatist who, at the close of the War, led a spectacular raid on Fiume. The Latin inscription on the back is a proud assertion that d'Annunzio and his comrades intend to remain in Fiume, which they claimed to be truly Italian, but the Nationalist hold on the city had to be relinquished.

These stamps are a reminder that changes due to conquest also may be traced by means of stamps. Thus British, Belgian and Portuguese troops took part in the attack on German East Africa, and overprinted stamps of all three countries were used during the campaign.

Similarly the postal changes made as the British advanced and the Turks retired in Mesopotamia form an accurate record of events in this theatre of the War. A very interesting case also occurred in the Marshall Islands in the Pacific Ocean. These German possessions were taken by the Japanese and handed over to Australia. The first stamps issued after the change took place actually were German in origin and were overprinted "G.R.I." to indicate British ownership!

Nearer home than either Italy or Russia, an event that to us is of equal importance led to the introduction of an entirely new issue of stamps. This is the establishment of the Irish Free State, and we illustrate one of the interesting stamps to which the change has given rise. This is the 1d. carmine stamp issued in 1922.

The Turkish stamp reproduced on this page is a reminder of one of the most astonishing revivals in history. At the close of the War, Turkey appeared to be at the last gasp. It seemed quite certain that no scrap of European territory would remain to her, and later she was faced with the prospect of the loss of more of her territory, this time in Asia. The genius of one man not only prevented the break-up of the country, but enabled Turkey to take effective possession of the little that remained to her of her former possessions in Europe. Through his efforts Turkey is at least well respected, if she is not quite the terror of Christian nations that she has been in past centuries.

The stamps of Turkey commemorate this wonderful revival, for a portrait of Mustapha Kemal Pasha, its author, appears on the most modern of Turkey's stamps. The one illustrated is a finely printed 25 gr. stamp. A point of interest is that the portrait shows the present ruler of Turkey in European dress. The inscription at the top is in Arabic script, but future issues in Turkey no doubt will add another chapter to the postal history of the country, for it is probable that the use of Arabic characters will be abandoned in favour of those used throughout Europe. Actually the lower values of the 1926 issue, from which this portrait stamp is taken, already bear European characters. In addition to the value tablet, the identifying label "Turk Postalari" is used in every case. In a previous issue, as far back as 1913, the label in French "Postes Ottomanes" was used but, presumably, because anything smacking of the Triple Entente was taboo in Turkey during the Great War, the use of this expression and the stamps bearing it was discontinued in 1915, and for a year or more early Turkish designs overprinted for War use were employed, pending a fresh issue that appeared in 1916.

Incidentally it is possible to trace in these issues an interesting compliment to the quality of British printing. The Turkish 1913 issue was engraved and printed by Messrs. Bradbury, Wilkinson and Company of London. During the war the Turks went to their Austrian Allies for fresh supplies of postage stamps. With the cessation of hostilities and the resumption of friendly trading relations between Britain and Turkey, the Turkish Government again placed their stamp printing contract with Bradbury, Wilkinsons.

Stamp Gossip

A Striking Roumanian Set

One of the handsomest commemorative series yet issued recently appeared in Roumania to commemorate the Union of Roumania and Transylvania. There are six values ranging from one leu to ten lei.

Our illustration of the one leu value shows a composite picture with King Ferdinand I, who died in 1927, the immediate predecessor and grandfather of the present king, as the central figure.

The other portraits are: top left, Etienne the Great; top right, Michael the Brave; bottom left, J. Corven; and bottom right, Constantine Brancoveanu, all famous figures in the history of the united countries.

First Lamp Jubilee

An interesting American commemorative to celebrate the 50th anniversary of the invention of the electric lamp recently appeared in the United States.

The new stamp is the same size as the ordinary 2-cent red stamp, and has for its central design a picture of the original lamp with rays issuing therefrom. Immediately above, and partly encircling the lamp, is a ribbon with the words "Edison's First Lamp"; above this and reaching the top of the stamp is a semi-circular panel with the words "United States Postage" in white Roman letters. In both upper corners are ribbon scrolls with the year "1879" at the left and "1929" at the right. On either side of the lamp and through the rays of light appears the following legend: "Electric Light's Golden Jubilee." The white numeral "2" appears in both lower corners within dark circles, which are connected by a dark panel forming the base of the stamp and containing the word "Cents" in white Roman letters.

It is of special interest to observe that the American Government has carefully avoided raking over the ashes of the old controversy anent the rival claims of Edison and Swan for priority in the invention of the electric lamp.

The new stamp was first placed on sale on 5th June, at the post office at Menlo Park, N.J. There was an unprecedented demand, a first issue of 180,000,000 being quickly sold, necessitating a second issue of 110,000,000. In view of the enormous revenue that the United States Government derives from the purchase of its commemorative stamps by collectors, its persistent refusal to allow a reasonably full use of stamp illustrations in literary matter is curiously antagonistic to the stamp collector's hobby.

We take this opportunity of making acknowledgment to Stanley Gibbons Ltd., for their courtesy in loaning the stamps from which the illustrations used with this article and the Stamp Gossip have been prepared.

come on you chaps!

Look at this Fairycycle! With balloon pneumatic tyres; powerful brakes and glittering handlebars—what a bike! What a proud machine to ride! Fancy going out to tea on it! Fancy turning up at school on it! Fancy the other chaps crowding round! Yes, you must wangle a Fairycycle.

Every possible detail of equipment on her. Dunlop balloon tyres for solid comfort, tangent spoke wheels with glittering plated rims; bell, pump, tool bag with real tools; stand, so that she stays upright when not in use, and carrier for the mater's parcels. Moreover, any Fairycycle can be fitted with a flat plate between the saddle and the handlebars showing a realistically painted motor cycle engine! Yes, the No. 8 Fairycycle is a machine in a thousand and is so strongly built that when you are big enough to hand it on to a small brother or sister it will still be well worth handing on.

L. BROS. Ltd. LONDON BROS. ENGLAND

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FAIRYCYCLE ASSOCIATION
Membership free to owners of genuine Fairycycles and badge attached to every machine. Simply fill up the form when you buy your Fairycycle, post it to Lines and you will then become a member. This is the badge of the Fairycycle Association.

Fairycycles are made in the following sizes at the prices stated:

Model A.—Well finished in black cycle enamel, ball-bearing pedals and plated handlebars. Dunlop saddle, 12″ tangent spoke wheels, ⅛″ rubber cushion tyres - **29/6**

Model Ax.—Like Model A, but larger size, with 14″ wheels and ⅛″ rubber cushion tyres - **33/-**

Model B. — Very suitable for young children being light and easy to ride. Has 12″ tangent spoke wheels with ⅞″ rubber tyres. Complete with chain-guard, reflector, stand and carrier - - - **39/6**

Model Bx.—As model B but larger size with 14″ wheels and ⅞″ rubber cushion tyres - **42/-**

Model C.—Raised pattern plated handlebars, has chain guard, stand, carrier, reflector and bell. Cycle pattern rim brake, 12″ tangent spoke wheels, adjustable ball-bearing hubs, 1″ imitation pneumatic tyres - **49/6**

Model Cx.—As model C but larger size with 14″ wheels - **52/6**

Model Px.—As model Cx but with 14″ × 1⅜″ Dunlop "Kempshall" pneumatic tyres - **55/-**

Model D.—Cycle type brakes, raised pattern plated handlebars, 2-coil spring saddle, etc. ½″ × ⅜″ roller chain, adjustable ball bearings throughout. 12″ tangent spoke wheels with 1″ imitation pneumatic tyres, complete with chain-guard, stand and carrier, reflector and bell - **59/6**

Model 6.—Strongly built for children up to 9 or 10 years old. 16″ tangent spoke wheels fitted 1″ imitation pneumatic tyres, adjustable ball-bearings throughout, cycle pattern rim brake. Imitation pneumatic tyres, 3-coil spring saddle, tool bag, bell, etc. - - - **70/-**

Model 8.—The "Rolls-Royce" of Fairycycles, raised pattern plated handlebars, 2¼″ buttress tread Dunlop balloon tyres. Plated ball-bearing pedals, tool bag, carrier, stand, bell, reflector and pump, etc. - - **87/6**

All these models with the exception of models A and Ax are finished in black or blue, with gold lines. Fairycycles can be obtained at all good toy shops, or write for illustrated leaflet.

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MOTORING EPITAPHS

Easy payments, no deposit,
Broke his neck, not worth it, was it?

At 90 miles rode Edward John,
The motor stopped, but Ed. went on.

Speed records Johnny tried to bust,
Ashes to ashes, dust to dust.

This stone's o'er the body of Tommy Mutch,
At breakneck speed he broke his clutch.

At whirl-wind speed drove Billy Grundy,
Relations note—his funeral's Monday.

Motor Cycle Trader.

* * * *

"Now, who remembers the name of the animal we were talking about yesterday?" asked the teacher.

"Please, sir, the Warmer."

"The Warmer! What nonsense, there's no such animal."

Another little hand shot up. "Please, sir, he means the Otter!"

* * * *

Boy (to his father): "Dad, can you sign your name with your eyes shut?"

Father: "Certainly."

Boy: "Well shut your eyes and sign this report card."

* * * *

"Did you tell that caller I had gone to Australia?" asked the boss.

"Yes, sir. I said you started this morning."

"Good! And what did he say?"

"He wanted to know when you'd be back, sir, and I told him immediately after lunch."

* * * *

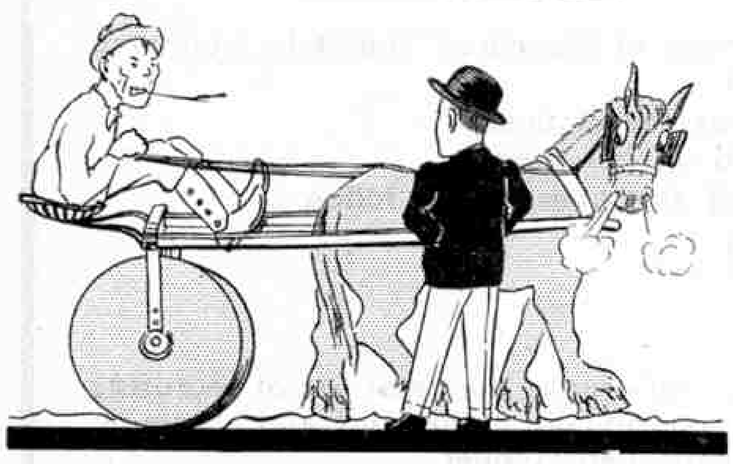
The boxer had received very severe punishment. By the end of the sixth round he had had enough. His seconds however, refused to throw up the sponge, and assured him that he still had a chance.

"But," pleaded the weary one, "I can't 'ardly see 'im, any'ow."

"Never mind, Bill," said one of the seconds. 'It 'im from memory."

* * * *

SCIENTIFIC AGRICULTURE



The visitor from town had asked so many questions that the farmer began to feel impatient.

"Why do you use such a heavy roller on your potato field?" was the next question.

"Well," replied the farmer, "you see, this year I am growing mashed potatoes."

* * * *

A man was told by his doctor that if he laughed ten minutes every day before meals his condition would improve. One day in a restaurant he was carrying out this prescription when a man at the opposite table asked what he was laughing at.

"Why, I'm laughing for my liver," he replied.

"Well, then," said the other, "I guess I'd better start laughing also; I ordered mine half-an-hour ago."

WHY IT WAS CONCEALED!

A visitor to a theatre in a small country town remarked to a friend that he was astonished such a small theatre should have a concealed orchestra, as many of the London theatres have.

"You just wait until it plays," replied his friend, a local man.

* * * *

Magistrate: "You are charged with driving your car at sixty miles an hour; smashing two telegraph poles; colliding with another car; going through a plate-glass window and injuring five people. What have you to say for yourself?"

Driver: "Doesn't the five shillings I paid for my licence entitle me to any privileges at all?"

Everybody's Weekly.

* * * *

HE ACCEPTED THE OFFER!

"If you can't do better work I'll have to hire another office boy!"

"Thank you, sir. I could get along much better with some help."

* * * *

A customer produced a very old pair of shoes and asked if they were worth repairing.

"Why not?" queried the shoe-maker. "The laces are quite good."

* * * *

Father was trying to interest his boy in matters geological. "Just think," he said, "that once upon a time there was a vast sea, teeming with fish of many kinds, covering this very land where we are standing."

"I can quite believe it, father," replied his son. "Why, here is a sardine tin."

* * * *

Travellers on the 8.49 knew Brown well. He was talkative at any time, but particularly so this morning. "Yes," he said, "would you believe it? Though I was so close at hand they stole my car!"

"H'm!" mumbled the man in the corner seat. "I've always heard these antique collectors will stop at nothing."

* * * *

It was a dark night at Aldershot, and in the gloom could be heard the sound of an approaching horse.

"Halt! Who goes there?" barked the picket.

"Regimental commander."

"Dismount, sir, and advance to be recognised.'

The colonel dismounted and came over to the picket, who presented arms with a snap.

"Proceed, sir!" he said.

As he laboriously got back on his horse, the colonel asked: "By the way, who posted you there?"

"Oh, nobody, sir," replied the picket, "I'm just practising."

* * * *

"Awful accident in the train to-day."

"What was it?"

"A woman had her eye on a seat and a man sat on it."

* * * *

Brown: "I once possessed a splendid dog. He could always distinguish between a vagabond and a respectable person."

Smith: "What's become of him?"

Brown: "Oh! I was obliged to give him away. He bit me."

HORRID THOUGHT

The lift shot past the thirtieth floor in the New York sky-scraper.

"What would happen if the lift went wrong and crashed to the bottom?" asked a cheerful passenger.

"Ugh!" shuddered the lift-man. "I'd lose my job."

* * * *

Customer: "Waiter, how long will my sausage be?"

Waiter: "About four-and-a-half inches, sir."

* * * *

Small Boy: "Father, can I have a penny for a poor man?"

Father: "Certainly, my boy. Where is he?"

Small Boy: "At the end of the road, selling ice-cream."

* * * *

"Ah wan' to be procrastinated at de nex' corner."

"You want to be what?" demanded the conductor.

"Don' loose you' tempah. Ah had to look in de dictshuonary myself befo' Ah found 'at 'procrastinated' means 'put off.'"

* * * *

Mr. Smith was staying at a small hotel and wished to catch a train early next morning. So he asked for an alarm clock.

"Here it is, sir," said the maid as she brought it in. "It's rather old and the works sometimes jam; but if it doesn't go off, just touch the little hammer and it'll ring all right."

* * * *

Three Welshmen in an inn were praising a glass of beer:—

First Man: "The best glass of beer I never tasted no more!"

Second Man: "So did I, neither."

Third Man: "Neither did I, too."

Liverpool Daily Post.

* * * *

Beggar: "Spare a copper, please, sir."

Charitable old gent: "I haven't any change on me now, but I'll give you something on my way back."

Beggar: "Very well, but you don't know how much I've lost on credit already."

* * * *

The boat was sinking. In a solemn voice the captain asked the crew: "Is there anyone who is pious and can say a prayer?"

"I," said one of them.

"Then pray, my boy, and ask God to save you there are ten of us and only nine lifebelts."

* * * *

TELL THE HORSE!

Irate Farmer: "Hi! Can't you see that sign 'Private Property'? Why don't you keep off?"

Horseman (hanging on for dear life): "Don't tell me, tell the horse!"

* * * *

Farmer Jones had just retired and moved to town. In the morning, after spending the first night in the new home, his wife said, "Well, Pa, ain't it about time you was getting up to light the fire?"

"No, siree," replied the old man. "I'll call the fire department. We might as well get used to these city conveniences right now."

* * * *

"Guard!" shouted the irate passenger, "that was my station; why didn't you stop?"

"We don't stop there any longer," explained the guard. "You see, the engine driver's not on speaking terms with the station master."

The 1929 Jaeger Meccano Jersey

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Pure Wool

JERSEYS & SUITS

MADE SPECIALLY FOR MECCANO BOYS

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Jersey No. BJ169 Chest 22 in., 7/–, rising 9d. every 2 in. to size 30 in.
Jersey Suit No. 896 Chest 20 in., 13/–, rising 1/– every 2 in. to size 26 in.
¾ Hose. Turnover Tops to match, 2/9 for size 3, to 3/9 for size 10.

Colours—Navy, Steel Grey, Fawn, French Grey, Saxe, Brown Mixture, Fawn Mixture, Saxe Mixture,
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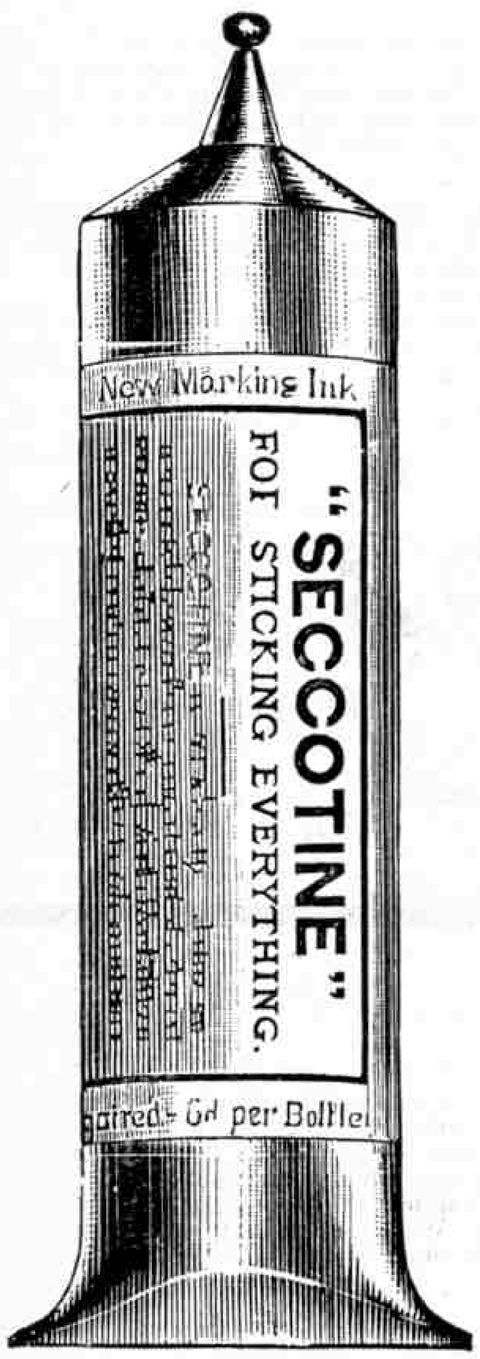

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The World's Great Adhesive. **Registered Trade Mark**

Children know its value. Some time ago we heard of

a boy, who, having his attention called to the beauty and long-standing of King's College Chapel at Cambridge, hazarded the opinion that it had been put together with Seccotine. We have heard, recently, too, of

a small girl, who thought the old nursery rhyme of "Sing a Song of Sixpence" might be improved by bringing Seccotine into it. It will be remembered that

The maid was in the garden, putting out the clothes,
When by came a blackbird and snapp'd off her nose.

The child, disliking this unhappy ending, supplied the lines which follow:

The King sent through the country
To find his wisest men,
They bought a tube of Seccotine,
And stuck it on again.

The Grown-ups have discovered endless novel uses for Seccotine. Of course, the great use of Seccotine is the making or mending of articles of wood, but the world is continually discovering and becoming enthusiastic over services which it is found Seccotine will unexpectedly render.

Seccotine is on sale all the world over, from China to Peru, in shops that are numberless.

PRICE 4½d., 6d. and 9d. PER TUBE

Bulk packages are supplied for manufacturing purposes.

Interesting booklet, free on application to:

McCAW, STEVENSON & ORR LIMITED

The Linenhall Works BELFAST

THE BRISTOL LUCIFER BIPLANE CONSTRUCTION SET

Fine fun for holidays!

Holidays with an Appleby Model Aeroplane are great fun and no boy should be without one. The model is most realistic and exactly as shown in the illustration. The elastic motor is extra powerful and is totally enclosed in the fuselage. When you have made up the model you just wind up the propeller and place on some smooth ground. The model will roar away from a standstill, then after a run of about 6 feet, will rise gracefully into the air, and complete its flight with a perfect landing. Length of model 14½ inches.

Complete set of cardboard parts, metal fittings and components, packed in box, with instructions.

PRICE 2/-

Post and packing 6d. (Postage extra abroad).

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If you have any difficulty in obtaining your model set, you can receive one by return of post direct from us upon receipt of 2/6 postal order. Foreign and Colonial customers should send 3/6 to cover extra postage and packing.

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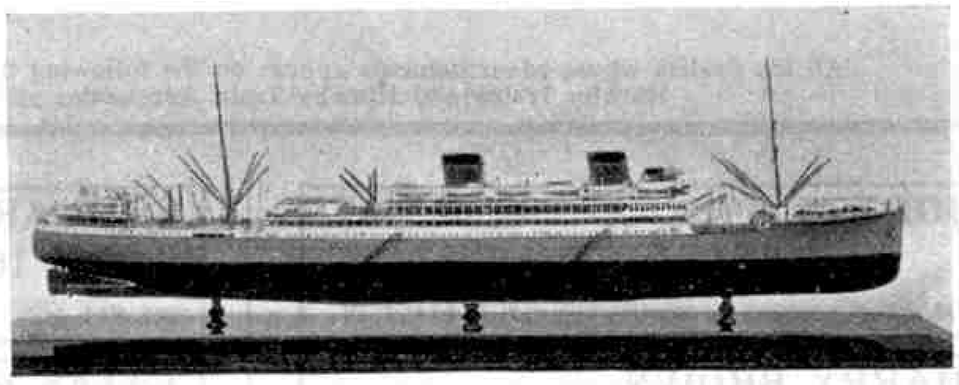

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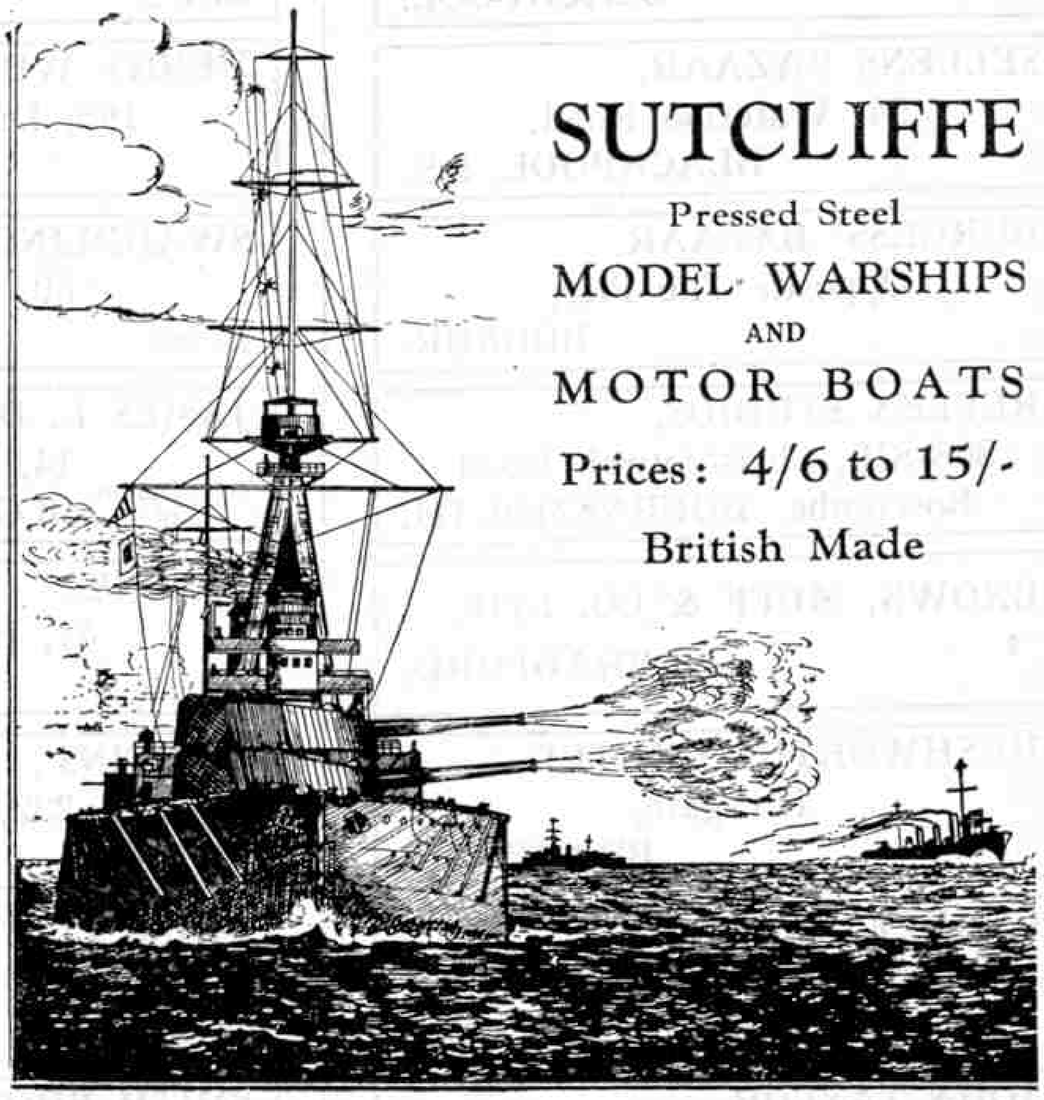

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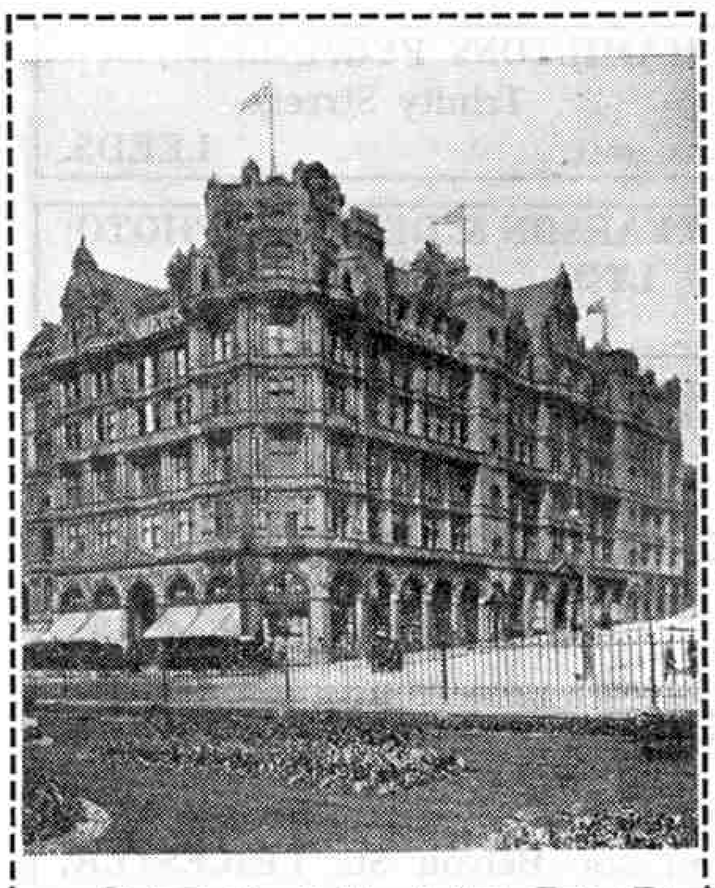

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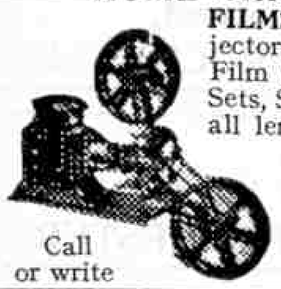

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Price per tin 8d.

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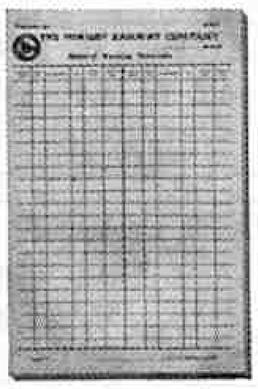

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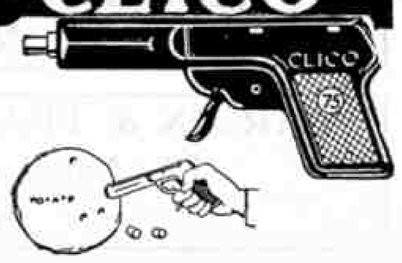

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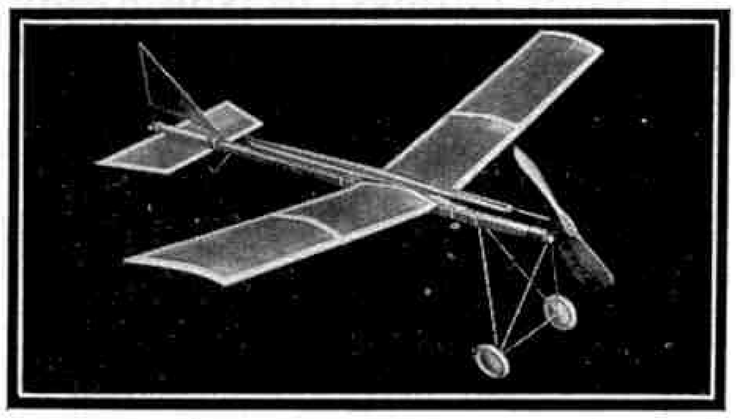

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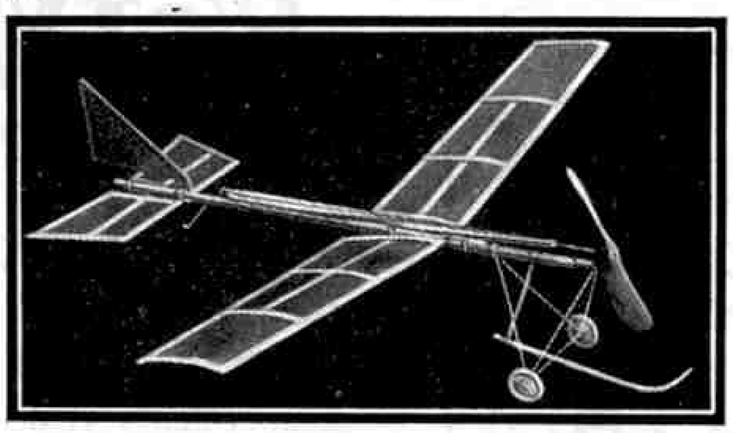

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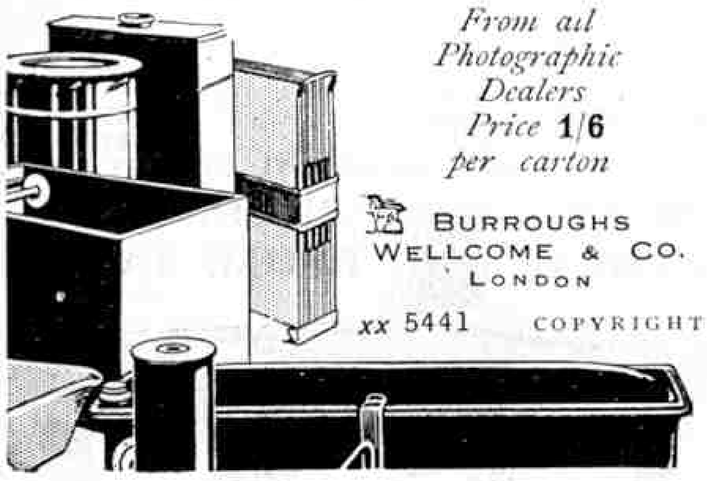

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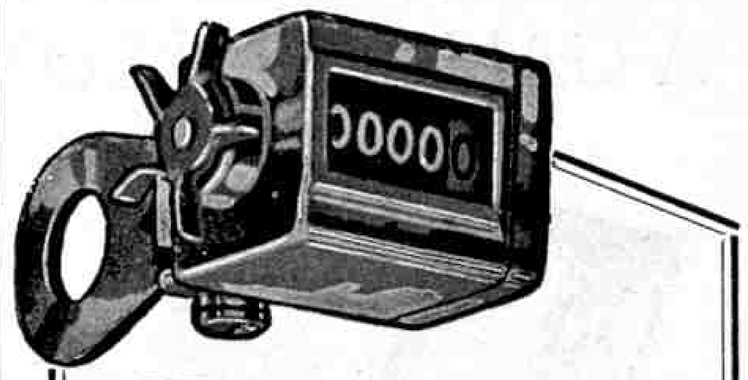

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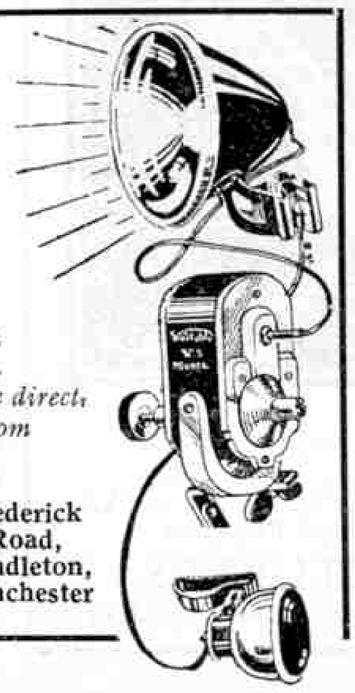

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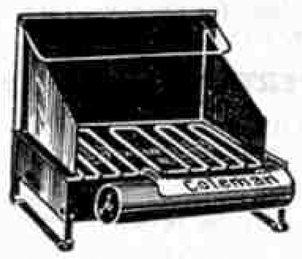

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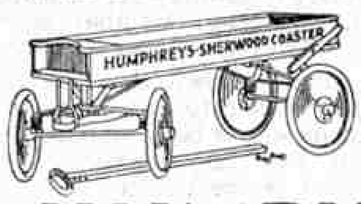

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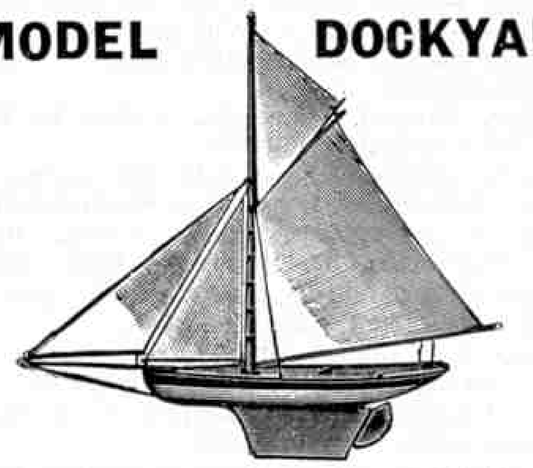

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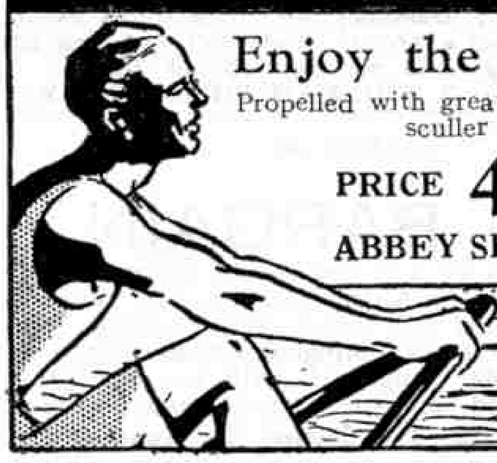

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Attractive Stamp Wallets—hold 300 stamps. 1/- post free.—Botham, 59, Constantine Road, Colchester.

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A new set of Postage Stamps from this British Possession sent free of charge to bona-fide applicants for selections of duplicates on approval.
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Get busy on
A
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I offer collectors for **1/- post free,** a fine used **10/- stamp of Union of S. Africa** (cat. 3/6, and **not** overprinted). A grand two colour King Georgian (blue and green), watermark, **Springbok's head.** Write for **liberal "Sea-Syde"** approvals with 1/- and get it **by return.** Good discount, bonus, and fine list.
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MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICES:—
BINNS ROAD, LIVERPOOL, ENGLAND.
Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/- for six issues and 8/- for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/-. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

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Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

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Remittances. Postal Orders and Cheques should be made payable to Meccano Ltd.

Ordering the "M.M." Overseas

Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers, or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/- per copy (postage extra), and the subscription rates 7/- for six months and 14/- for 12 months (post free); Canada, where the price is 15c. per copy, and the subscription rates 75c. for six months, and $1.50 for 12 months (post free).

The U.S.A. price is 15c. per copy, and the subscription rates 90c. and $1.75 for 6 and 12 months respectively (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

CANADA: Meccano Ltd., 45, Colborne Street, Toronto.
UNITED STATES: Meccano Co. Inc., Elizabeth Av., Elizabeth, N.J. Meccano Co. Inc., 200, Fifth Avenue, New York.
AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.
NEW ZEALAND: Models Ltd., Kingston & Federal Streets, Auckland.
SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
INDIA: Karachi: Bombay Sports Depot, Elphinstone Street. Bombay: Bombay Sports Depot, Dhobi Talao. Calcutta: Bombay Sports Depot, 13/C, Old Court House Street.

The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor.

"MECCANO MAGAZINE" BINDERS

There is no better way of keeping your Magazines clean and tidy than by binding them in one of the special binders we supply.

These binders have strong stiff backs, covered with black imitation leather, tastefully tooled, and are lettered in gold. The large binder holds 12 Magazines—price 4/6 post free. The small binder holds 6 Magazines—price 3/- post free. Meccano Ltd., Binns Road, Old Swan, Liverpool.

GAMAGES

The Boys' Own Store

VISIT US DURING OUR GREAT BOYS' WEEK, SEPT. 9-14th. See below

FOOTBALL!

Write for Copy of Gamages' Famous Football Catalogue. The Best Guide to all Football Requirements.

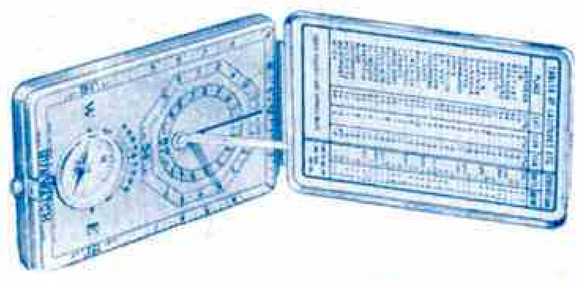
We stock all Hornby Train and Meccano Parts and send them Carriage Paid to any Station U.K.

THE FAMOUS MOTOR HYDROPLANE "MAPLE LEAF V"

The hull is constructed of selected yellow pine and has mahogany spray hood and deck fittings, brass rudder, tiller and rake, and strong wire guard to protect the brass propeller. Enamelled in a beautiful shade of green; the hood, deck and fittings being varnished; 26 ins. long. Fitted steam engine and boiler. "MAPLE LEAF V" will run for 30 minutes and cover a long distance. Post free. Price **22/6**

The WRIGHT FLYER

Is a scientifically designed toy airplane which will glide, "loop the loop," do the "Immelmann" or barrel roll. Length 13 ins., spread 14 ins., packed flat in an envelope with full instructions and illustrations. Obtainable only at Gamages. Post Free. Price **1/9**



The Ansonia Sunwatch

"The Tickless Timepiece"

Vest pocket. Records accurately the time of day in any part of country. Post Free. **4/6**

Boy's Three Draw Telescope

Made in Polished Brass. Specially suitable for Boys on Country Rambles, etc.

3/6

Post 2d.

Best quality 2 draw Powerful Lenses.

10/6 post free.

Now You Meccano BOYS! Read this!

WE are having great times during the week September 9th to 14th. If you are in Town come along and have a look round—it is the most wonderful show we have put up for a long time. Here are a few of the attractions.

CONJURING DISPLAYS

Mr. Stanley Collins the world famous conjurer from Maskelyne's Theatre, will give special shows at intervals throughout the week.

LECTURES

by Major T. M. Cartwright, M.C., B.Sc.

The famous Lecturer on **"Games and How to Play them,"** aided by a cinema display, showing various great athletes in action.

Cabin of a 40-Seater Handley-Page Air Liner

The Automatic Guide to Air Travel.

A section of the Fuselage of a 22-seater Liner.

A full size Desoutter Cabin Monoplane.

Marconi A.D.6.H. Aircraft Telephone equipment as used by all big Air Liners.

There are a dozen different types of model 'planes all built to scale which the young model engineer will delight to see, while the Toy Department is simply alive with special demonstrations of all sorts :—

Meccano
Chemical Experiments
Shadow Punch Ball
Working Model Steam and Electric Trains
Working Model Stationary Engines
Model Steam Yachts
Hot Air Boats
Hornby Trains
Model Flying Aeroplanes
Model Constructional Aeros and Zepps.
Building Sets

GAMAGES, HOLBORN, LONDON, E.C.1. City Branch: 107, CHEAPSIDE, E.C.2

MECCANO

1929 OUTFITS

No. OO Outfit

The special Manual included with this Outfit shows how 205 splendid models can be constructed.

No. 1 Outfit

This popular Outfit contains an excellent variety of Meccano parts, together with a Manual illustrating 564 models that may be constructed.

No. 3 Outfit

This excellent Outfit contains many Meccano parts of an advanced engineering type and a Manual showing how to build 663 models.

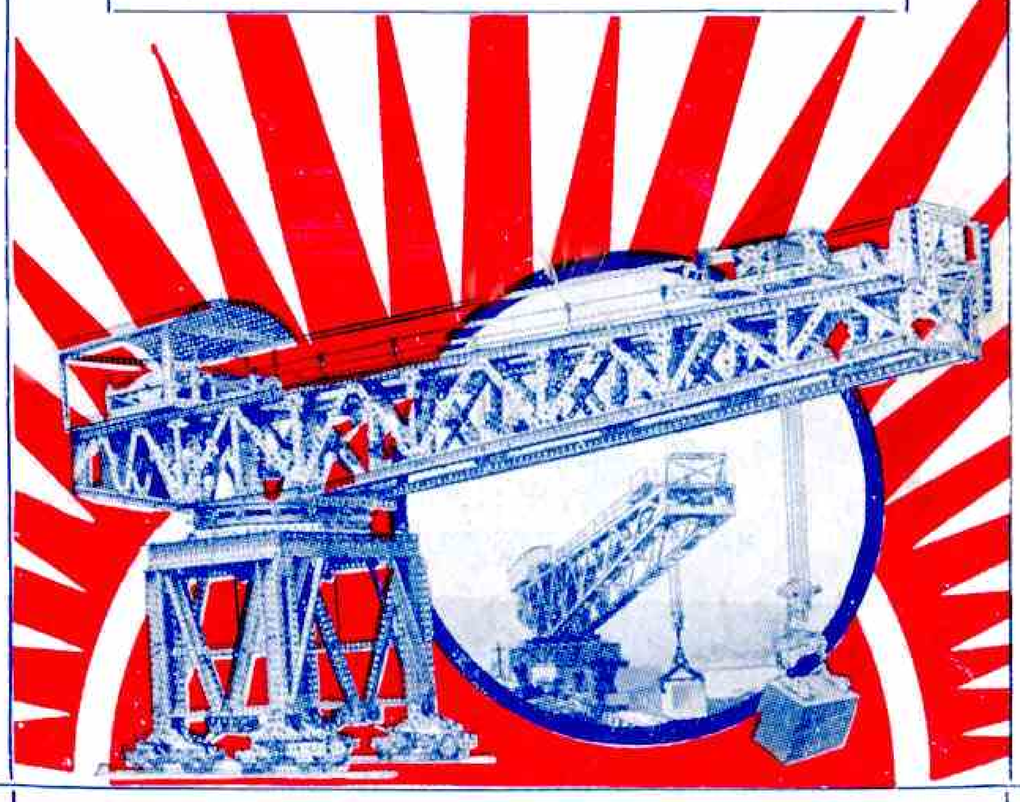
Super-value Outfits that build more models than ever

In just the same manner as real engineering advances as a result of experiment and experience, so Meccano—real engineering in miniature—continues its march of progress. "Improvement" is the Meccano watchword as a glance at the latest Manuals of Instructions will show. Never before have so many wonderful engineering models been featured. Take, for example, the Meccano No. 1 Outfit. Last year we illustrated 348 models that could be built with this Outfit . . . this year the instructions that are included with the Outfit show a wonderful range of 564 models that it will build. Even this figure does not exhaust the capabilities of the Outfit, however, for as every Meccano boy knows, the number of models which may be built with each Outfit is almost incalculable.

Ask your dealer to tell you about the latest developments.

Prices of Complete Outfits

Outfit	NUMBER OF MODELS 1928	1929	Price
No. 00	116	205	3/6
„ 0	184	344	5/-
„ 1	348	564	10/-
„ 2	396	612	16/-
„ 3	447	663	27/6
„ 4	504	720	50/-
„ 5 (Carton)	547	764	65/-
„ 5 (Enamelled Cabinet)	547	764	95/-
„ 6 (Carton)	594	811	115/-
„ 6 (Enamelled Cabinet)	594	811	150/-
„ 7	626	846	365/-



No. O Outfit

The Manual of Instructions included gives examples of 344 models that may be built with the Outfit.

No. 2 Outfit

This splendid Outfit builds bigger and better models than ever before. Full instructions for building 612 models are included.

No. 4 Outfit

Examples of 720 models that may be constructed are illustrated in the Manuals that are included in this Outfit.

THE FINEST HOBBY IN THE WORLD

MECCANO LTD.
Binns Road, Old Swan
LIVERPOOL

REAL ENGINEERING IN MINIATURE

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